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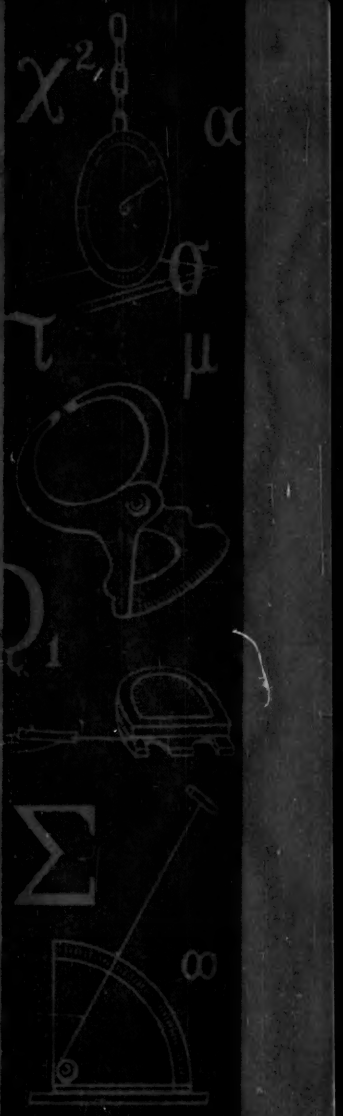

AMERICAN ASSOCIATION FOR HEALTH PHYSICAL EDUCATION AND RECREATION

Vol. 29, No. 4
December 1958

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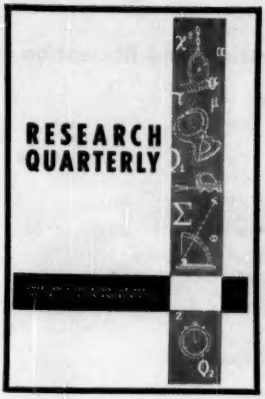

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CONTENTS

Effectiveness of a General Basic Skills Curriculum for Junior High School Girls
Marion R. Broer 379

Two Methods of Weight-Training for Children with Spastic Type of Cerebral Palsy
Alfred Healy 389

Selected Factors Associated with Wrestling Success Walter Kroll 396

Interests of 4000 High School Pupils in Problems of Marriage and Parenthood
Joseph E. Lantagne 407

Analytical Study of School Health Service Practices in the United States
Elizabeth A. Neilson and Leslie W. Irwin 417

Venous Blood Pressure Measurements during Exercise by the Strain Gauge and Pressure Amplifier Method Rene H. Rochelle 459

Psychological Refractory Period in Simple Paired Responses A. T. Slater-Hammel 468

Notes and Comments—Effect of Vigorous Swimming on Blood Viscosity of Conditioned Subjects, Hugh L. Thompson, 482; Comments on the Article "Influence of Perceptual Stimulus Intensity on Speed of Movement and Force of Muscular Contraction," John M. Vallerga, 483

Research Abstracts 484

Life and Honorary Members of AAHPER 493

Representative Assembly of AAHPER, 1958-59 496

Index to Volume 29 499

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Effectiveness of a General Basic Skills Curriculum for Junior High School Girls

MARION R. BROER
University of Washington

Abstract

Two seventh grade classes were chosen at random to receive experimental basic skills instruction which emphasized problem solving and student understanding of simplified mechanics prior to instruction in volleyball, basketball, and softball. Three seventh grade classes constituted the control group. With less instruction in volleyball and basketball and an equal amount in softball, the experimental group surpassed the control group on eight sport skill tests (three significant at the 1 percent level). Their mean total sport skill score was also significantly higher. These differences were not due to superiority of the experimental group in motor ability, physical development, or intelligence.

FOR the past several years the Women's Department at the University of Washington has studied the motor ability of entering freshman women. It has been found that many such students display a low level of skill and have little knowledge of the way to move their bodies effectively. Students with unusual difficulties were chosen for study and were enrolled in a general basic skills course. Its purpose was to give an understanding of the mechanics of the body and their application to activities of everyday living as well as to sport activities. It was found that the course did aid these students in acquiring knowledge and skill in sports activities studied at a later date (1). In their evaluation of the course, the students commented that they would have appreciated an opportunity for this type of instruction at an earlier age. The question was frequently asked, "Why weren't we taught these things before?"

In the fall of 1955 the opportunity to work with junior high school girls was offered to the investigator. The year 1955-56 was used to set up testing procedures and the year 1956-57 was devoted to the basic skills instruction and follow-up.

Purpose

The purpose of this study was to determine whether the teaching of sports activities to junior high school girls could be made more effective if preceded by instruction in a general basic skills curriculum which emphasized problem solving and understanding of simplified mechanics.[1]

[1] For further information regarding the content and method of the experimental curriculum, contact the author.

Procedure

The study was limited to seventh grade girls enrolled in Morgan Junior High School, Seattle, during the school year 1956-57. Determination of effectiveness of the basic curriculum was limited to skills following instruction in volleyball, basketball, and softball, since these were the activities to which the major portion of the physical education program was devoted.

One year was spent in establishing the reliability of the skill tests used in this study (2).

Two of the five seventh grade classes in the Morgan Junior High School were chosen to receive instruction in the basic skills curriculum. The choice was based upon the time that the investigator could arrange to be away from the university campus. These two classes made up the experimental group. The other three seventh grade classes were studied as a control group.

It was reasoned that general motor ability, developmental level, and intelligence could influence the results of this study. To determine whether either group had an advantage in general motor ability at the beginning of the study, both the Scott Motor Ability Test and a modified Humiston Motor Ability Test were administered at the beginning of the school year. Differences between the mean scores of all groups were tested for significance.

Because of absences during the various testing periods, the groups for which all volleyball scores, all basketball scores, and all softball scores were available differed slightly. To determine whether this dropping of one or two individuals could influence results, the mean motor ability scores were checked for all groups, that is, for those who actually took all volleyball tests, for those who took all basketball tests, and for those who took all softball tests.

There was great variation in size and development among the students in all five of the classes, since they were at an age of rapid growth. The Wetzel Grid was used to determine whether the experimental classes happened to have girls who were at a higher or lower level of physical development.

The records of the school revealed that the intelligence scores available involved several different tests and that there were some students for whom no scores were available. It was, therefore, impossible to determine reliably whether these groups were matched on this factor. As an indication, however, the scores for those who had taken the California Mental Maturity Test, the S.R.A. Primary Ability Test, and the Otis Test (the only tests involving more than three students) were studied.

The experimental curriculum was taught by the investigator. The classes met every other school day for seven weeks, giving a total of seventeen periods of instruction. During this time the control group had instruction in speed-a-way, speedball, and volleyball. Volleyball instruction was begun in the control group classes eight periods before the end of the basic skills instruction for the experimental group and continued for four more class periods.

The experimental class was given instruction in volleyball during four class periods. Thus they had one-third as much time devoted to instruction in this sport as did the control classes. All instruction in sports for both the control and experimental groups was given by the regular junior high school physical education instructor.

The volleyball volley test and service test were administered to all (five) seventh grade classes at the end of the volleyball instruction.

Following this testing period, all classes began the unit in basketball. The experimental classes received approximately two-thirds as much instruction in basketball as did the control classes. At the end of the basketball unit three skill tests were administered to all classes: the basketball wall pass, a revised version of the Edgren ball handling test, and a 30-sec. shooting test which used a 7 ft. semicircular restraining line.

In the spring, all classes were taught a unit on softball, and, following this instruction, three skill tests were administered. An overhand throw for distance, an underhand throw for accuracy, and a batting test for distance (using a batting tee) were used.

All differences in the eight sport skill test scores of the experimental and control groups were studied. Throughout the study a "t" at the 5 percent level was considered to indicate a significant difference.

T-scales were constructed for all eight sport skill tests and a total sport skill score was found for those students who had completed all tests. The mean of the total scores of the experimental group was compared with that of the control.

The experimental classes were asked to write anonymous evaluations of the basic skills instruction. Their comments were studied. The junior high school instructor offered several comments.

Results

To determine whether any difference between groups which might be evident could be due to such factors as general motor ability, developmental level, or intelligence rather than the experimental curriculum, the scores for these three factors were studied first.

Motor Ability. There was less than one second difference in the mean Humiston Motor Ability Test scores of the total control and experimental groups regardless of the students absent from the various subsequent testing periods (Table 1). The Scott Test results again indicated little difference between these total groups. The slight differences that did exist were in favor of the control group. The results of both tests indicated that one of the experimental groups (D) may have had some disadvantage in general motor ability but that the total experimental and control groups were not significantly different. The absences from the various sport testing periods had little effect upon these results.

TABLE 1.—SUMMARY OF MOTOR ABILITY TEST RESULTS

	Revised Humiston Test[a]				Scott Test		
A. Mean, Standard Deviation, Sigma of Mean							
Those taking VB tests	N	M	σ	σ_m	Mean	σ	σ_m
A	30	46.2	6.3	1.15	203.1	30.5	5.56
Control B	28	47.0	6.9	1.31	198.6	33.8	6.38
E	30	47.7	6.1	1.10	195.4	25.7	4.69
ABE	88	47.0	6.4	.69	199.0	30.2	3.22
C	32	45.4	4.6	.81	203.8	27.6	4.87
Exp. D	18	50.2	5.7	1.34	178.8	47.2	11.12
CD	50	47.2	5.5	.78	194.8	37.2	5.23
Those taking BB tests							
A	32	46.1	5.5	.97	202.9	30.1	5.32
B	25	46.1	4.7	.94	199.7	34.5	6.90
Control E	30	47.2	6.3	1.15	200.6	31.6	5.78
ABE	87	46.5	5.6	.60	201.2	32.0	3.43
C	32	45.4	4.7	.82	204.0	27.5	4.86
Exp. D	17	50.5	5.7	1.37	179.2	48.5	11.77
CD	49	47.2	5.6	.80	195.4	38.1	5.44
Those taking SB tests							
A	31	45.6	6.2	1.12	204.4	29.0	5.21
B	27	46.9	6.9	1.31	199.6	34.0	6.53
Control E	27	48.0	6.3	1.21	198.2	32.4	6.24
ABE	85	46.8	6.5	.71	200.9	31.9	3.46
C	29	45.3	4.5	.83	206.6	27.5	5.09
Exp. D	17	50.5	5.7	1.37	179.2	48.5	11.77
CD	46	47.2	5.6	.82	196.5	39.0	5.75

B. Significance of Largest Differences

VB-A-D[b]	4.0	1.77	2.25	2%	24.3	12.4	1.95	6%
B-D	3.2	1.88	1.70	9	19.8	12.8	1.54	12
E-D	1.2	–	–	–	24.9	12.0	2.08	4
C-E	2.3	1.37	1.67	10	8.4	–	–	–
C-D	4.8	1.57	3.05	1	25.0	12.1	2.05	4
BB-A-D	4.4	1.68	2.62	1	23.7	12.9	1.83	7
B-D	4.4	1.66	2.65	1	20.5	13.6	1.50	14
E-D	3.3	1.79	1.86	6	21.4	13.1	1.63	10
C-D	5.1	1.59	3.14	1	24.8	12.7	1.94	6
SB-A-D	4.9	1.77	2.77	1	25.2	12.9	1.95	6
B-D	3.6	1.89	1.90	6	20.4	13.5	1.51	14
E-D	2.5	1.82	1.37	17	19.0	13.4	1.43	15
C-E	2.7	1.47	1.84	7	8.4	–	–	–
C-D	5.2	1.60	3.25	1	27.4	12.8	2.13	4

[a] Since the Humiston Test gives a time score the lower score is better.
[b] Difference listed is in favor of first group.

Developmental Level. Since a consideration of absentees had so little effect on the motor ability results, all students in each group who took any of the sport tests were considered in the study of the Wetzel Grids. There was little difference between the Wetzel Grid developmental level means of the control and experimental groups. It is interesting that while experimental group C had some advantage over D on motor ability, the advantage shifted to D when developmental level was considered. Group D was equal to control groups A and B on this measurement. Control group E had some slight disadvantage, but the mean developmental level scores of the total control and experimental groups were practically identical (Table 2).

TABLE 2.—SUMMARY OF WETZEL GRID DEVELOPMENTAL LEVEL RESULTS

		Mean	σ	σ_m	Groups	Diff.	σdiff.	t	Sig. Level
Control Groups									
A	32	130.6	14.7	2.60	A-E	7.1	3.69	1.93	6%
B	28	131.6	20.4	3.84	B-E	8.1	4.66	1.73	9
E	31	123.5	14.6	2.61	D-E	7.9	4.74	1.67	10
ABE	91	128.5	16.9	1.77					
Experimental Groups									
C	33	126.7	15.4	2.68					
D	18	131.4	16.8	3.95					
CD	51	128.4	15.9	2.23					

Intelligence. Since the intelligence data were incomplete, they could be taken only as an indication of the relative intelligence level of the two groups. These results, however, indicated that the experimental group did not have an advantage over the control due to any superiority in intelligence (Table 3).

TABLE 3.—MEAN INTELLIGENCE TEST SCORES

Test	Group	N	Mean	σ
California Mental Maturity	Control	34	109.2	12.5
	Exp	24	103.5	14.9
S. R. A.	Control	32	105.4	15.3
	Exp	11	103.6	7.8
Otis	Control	6	103.3	7.5
	Exp	2	90.5	8.6

Volleyball Tests. The results of the volleyball service test (Table 4) show that one experimental group (D) had a higher mean score than did any of the three control groups, and the other experimental group (C) had a slightly higher score than one of the control groups. None of the differences was great.

TABLE 4.—SUMMARY OF VOLLEYBALL TEST RESULTS

	N	Mean	σ	σ_m	Groups	Diff.	σdiff.	t	Level of Sig.
Serve									
Control Groups									
A	30	44.17	19.65	3.59	B-E[a]	5.94	4.93	1.20	24%
B	28	47.21	19.42	3.67	D-E	6.95	4.80	1.45	15
E	30	41.27	18.04	3.29					
ABE	88	44.15	18.97	2.02					
Experimental Groups									
C	32	44.53	14.28	2.52					
D	18	48.22	12.88	3.03					
CD	50	45.86	13.78	1.94					
Volley									
Control Groups									
A	30	20.33	7.08	1.29	E-A	3.90	1.75	2.23	3
B	28	20.25	7.38	1.39	E-B	3.98	1.83	2.17	3
E	30	24.23	6.48	1.18	C-A	5.80	1.95	2.97	1
ABE	88	21.64	7.15	.76	C-B	5.88	2.02	2.91	1
Experimental Groups					C-E	1.90	1.88	1.01	22
C	32	26.13	8.23	1.45	D-A	7.00	2.04	3.43	1
D	18	27.33	6.67	1.57	D-B	7.08	2.10	3.37	1
CD	50	26.56	7.66	1.08	D-E	3.10	1.97	1.57	12
					CD-ABE	4.92	1.32	3.73	1

[a] Difference in favor of first group.

On the volley test both experimental groups were superior to all three control groups. In five out of seven comparisons between experimental and control groups, these differences in favor of the experimental groups were significant.

In four instructional periods for volleyball the experimental group was able to equal the service ability and surpass the volley ability of the control groups, which had had twelve periods of instruction in volleyball.

Basketball Tests. Except for two comparisons, the two experimental groups did better than any of the three control groups on the three basketball tests. One control group was slightly higher than one of the experimental groups in the shooting test and another control group was slightly higher than the same experimental group in passing (Table 5). The total experimental group surpassed the total control on all three tests, but the difference for the ball handling test was the only one that was statistically significant.

Again the experimental groups, with less instruction in skills, did as well or better than the control groups.

Softball Tests. The results for the three softball tests were similar. Again there were only two comparisons in which a control group equaled an experimental group. In the overhand throw two control groups equaled the mean score of one of the experimental groups. In all comparisons of the experi-

TABLE 5.—SUMMARY OF BASKETBALL TEST RESULTS

	N	Mean	σ	σ_m	Groups	Diff.	σdiff.	t	Level of Sig.
				Shooting					
Control Groups									
A	32	40.69	9.22	1.68	A-B[a]	3.85	2.57	1.50	13%
B	25	36.84	9.95	1.99	C-B	3.91	2.56	1.53	12
E	30	38.63	5.99	1.09	D-B	3.45	2.80	1.23	22
ABE	87	38.87	8.53	.91	CD-ABE	1.72	1.50	1.15	25
Experimental Groups									
C	32	40.75	8.52	1.50					
D	17	40.29	8.12	1.97					
CD	49	40.59	8.30	1.18					
				Passing					
Control Groups									
A	32	67.28	8.44	1.54	B-E	3.41	2.51	1.36	18
B	25	68.48	10.41	2.08	C-E	4.02	1.93	2.08	4
E	30	65.07	7.69	1.40	CD-ABE	1.73	1.44	1.20	23
ABE	87	66.86	8.82	.94					
Experimental Groups									
C	32	69.09	7.50	1.32					
D	17	67.65	9.05	1.95					
CD	49	68.59	7.64	1.09					
				Handling					
Control Groups									
A	32	30.53	6.67	1.22	B-A	3.27	1.64	1.99	5
B	25	33.80	5.72	1.14	B-E	2.53	1.63	1.55	12
E	30	31.27	6.38	1.16	C-A	7.28	1.39	5.24	1
ABE	87	31.72	6.38	.68	C-B	4.01	1.36	2.95	1
					C-E	6.54	1.38	4.74	1
Experimental Groups					C-D	2.05	1.27	1.61	11
C	32	37.81	4.51	.73	D-A	5.23	1.57	3.33	1
D	17	35.76	4.25	1.03	D-B	1.96	1.54	1.27	20
CD	49	37.10	4.25	.60	D-E	4.49	1.56	2.88	1
					CD-ABE	5.38	.92	5.85	1

[a] Difference in favor of first group.

TABLE 6.—SUMMARY OF SOFTBALL TEST RESULTS

	N	Mean	σ	σ_M	Groups	Diff.	σdiff.	t	Level of Sig.
Overhand Throw									
Control Groups									
A	31	70.97	22.60	4.13					
B	27	72.22	23.79	4.57					
E	27	72.41	22.25	4.27					
ABE	85	71.82	22.61	2.45					
Experimental Groups									
C	29	72.07	20.98	3.89					
D	17	76.76	16.58	4.02					
CD	46	73.80	19.41	2.86					
Batting									
Control Groups									
A	31	176.35	126.22	23.05					
B	27	191.48	108.77	20.91					
E	27	187.22	111.13	21.37					
ABE	85	184.61	98.60	10.69					
Experimental Groups									
C	29	199.31	125.99	23.37					
D	17	192.94	89.69	21.76					
CD	46	196.96	112.90	16.65					
Underhand Throw									
Control Groups									
A	31	48.29	16.98	3.10	C-A[a]	15.88	4.49	3.54	1%
B	27	50.74	17.45	3.35	C-B	13.43	4.70	2.86	1
E	27	53.37	17.61	3.38	C-E	10.80	4.72	2.29	3
ABE	85	50.68	17.25	1.87	D-A	17.65	5.72	3.09	1
Experimental Groups					D-B	15.20	5.89	2.58	1
C	29	64.17	17.78	3.28	D-E	12.57	5.91	2.13	4
D	17	65.94	19.98	4.84	CD-ABE	14.15	3.29	4.30	1
CD	46	64.83	18.39	2.71					

[a] Difference in favor of first group.

mental and control groups on the underhand throw (accuracy), the experimental group was significantly superior (Table 6).

Total T-Score. When the total sport skill test scores (total on all eight tests) were compared, it was found that both experimental groups surpassed all three control groups and their superiority was highly significant (Table 7).

Subjective Evaluation. Forty-five students were present the day evaluations were written. Students were asked to make anonymous comments about the course: whether they felt this type of instruction had been of help to them, whether other activities should have been included, and whether some that were included should have been omitted.

TABLE 7.—SUMMARY OF TOTAL T-SCORE RESULTS

	N	Mean	σ	σ_m	Groups	Diff.	σdiff.	t	Level of Sig.
Control Groups					Con.				
A	28	386.04	64.69	12.22	B-A*	5.68	18.04	.315	
B	25	391.72	66.36	13.27	A-E	5.08	16.62	.306	
E	25	380.96	56.28	11.26	B-E	10.76	17.40	.618	
ABE	78	386.23	62.02	7.02	Exp.				
					C-D	4.50	14.43	.312	
Experimental Groups					Exp.-Con.				
C	28	420.32	55.07	10.41	C-A	34.28	16.05	2.14	4%
D	17	415.82	41.20	10.00	C-B	28.60	16.87	1.70	9
CD	45	418.62	49.83	7.42	C-E	39.36	15.33	2.57	1
					D-A	29.78	15.79	1.89	6
					D-B	24.10	16.61	1.45	15
					D-E	34.86	15.05	2.32	3
					CD-ABE	32.39	10.22	3.17	1

* Difference in favor of first group.

Although nothing was said about indicating whether they had enjoyed the class, several comments along this line were made. It is interesting to note that the three students who made negative comments followed them by a "but" clause indicating that they felt the instruction was useful. One student wrote that she had never been "good in gym, and this course seemed to give me the idea"; another stated, "I don't make such a fool of myself when I play games now"; a third indicated she felt that more of this instruction should be given; a fourth said all of the classes should be given this course.

At the end of the year the physical education instructor offered the unsolicited comment that she had felt a great difference in teaching the experimental

TABLE 8.—NUMBER OF STUDENTS MAKING ANONYMOUS COMMENTS

N = 45

General Value:	No.	Enjoyment:	No.
Will help a lot	17	Was interesting and exciting	1
Will help in looks	4	Has been fun	5
Will help in sports	16	Liked course	7
Will help in High School Gym	2	Didn't like it but learned things	
Will help in daily activities	3	things that are useful	1
Will help when grow up	7	Felt it rather boring but will help	
Will help socially	5	me a lot	1
Total indicating helpfulness	42	Didnt' like throwing but it will	
		help me so glad I learned	1

Specific Activities of Value:	No.		No.
Posture	19	Running	8
Walking	14	Carrying and Lifting	7
Sitting	13	Jumping	1
Throwing	12	Balance	1

students and the control group, that the experimental students had seemed to "catch on" much more quickly.

During the following fall term the instructor indicated that she could pick out the experimental students in speed-a-way because they were learning more quickly. This is interesting in view of the fact that the control students had had instruction in speed-a-way the previous year and the experimental had had none.

This investigator found that the response of the groups to the teaching of the experimental curriculum was very gratifying. When given problems to solve, the groups worked diligently and evidenced a desire to share their conclusions with members of other groups. Discussion was lively, and rarely was it necessary for the investigator to bring out specific methods or reasons for them. Following student experimentation with the problems set up, leading questions resulted in some student bringing out each important point.

Summary of Results

With one-third as much time given to instruction in volleyball, two-thirds as much in basketball, and an equal amount in softball, the total experimental group surpassed the total control group on all eight sport skill tests. This difference was significant at the 1 percent level for three of these tests. The mean total sport skill score (on all eight tests) of the experimental group was also significantly higher than that of the control group. These differences were not due to any superiority of the experimental over the control group in general motor ability, physical development, or intelligence.

The students indicated in anonymous, written evaluations that they felt the course was of value and many remarked upon their enjoyment of it.

Conclusion

Within the limitations of this study,the following conclusions seem justified:

1. A general basic skills curriculum using a problem solving approach to an understanding of simplified mechanics can lead to more efficient learning of specific physical education activities.
2. Such a course is of interest to girls in seventh grade.

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(Submitted 3/14/58)

Two Methods of Weight-Training for Children with Spastic Type of Cerebral Palsy[1]

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Abstract

Five boys, all afflicted with the spastic type of cerebral palsy, engaged in a weight-training program consisting of static-contractions with one leg and concentric-contractions with the other leg. The tests used to measure the strength of the extensor muscles and the range of motion of the lower leg before, during, and after the eight-week program showed that both methods produced statistically significant increases in strength and in range of motion. There was no significant difference between the two methods.

THE PURPOSE of this study was to compare the strength and the range of motion developed by concentric-contraction and static-contraction programs of weight-training for children afflicted with the spastic type of cerebral palsy.

The term cerebral palsy embraces a group of conditions varying considerably in degree and manifestation but having in common a lesion of the brain affecting motor control (6). The various physical and psychological limitations of the cerebral-palsied spastic are as follows. Their gross movements are exaggerated, stiff, and uncertain because of involuntary contraction of the affected muscles and the hypersensitivity of the stretch reflex. The spastic is usually afraid of encountering new situations outside his familiar surroundings. Speech defects and visual problems are present in about one-half of the cerebral palsy population.

It is apparent that there is a definite need for proper medical diagnosis and prescription when dealing with the cerebral-palsied or other individuals with neuromuscular disorders. This study was made under the direction of a medical doctor.

In 1945 DeLorme (1) recommended that heavy-resistance exercises be utilized for the patient undergoing physical rehabilitation. This program consisted of performing 70 to 100 executions, with weights not to exceed the 10-execution maximum. The term *10-execution maximum* means the heaviest weight that can be used successfully in performing an exercise a

[1]This study was made under the joint guidance of R. R. Rembolt, M.D., medical director, and Orrin H. Marx, M.A., supervisor of physical education, University of Iowa Hospital School for Severely Handicapped Children, and Frank D. Sills, Ph.D., in charge, Physical Education Research Laboratory, State University of Iowa.

maximum number of 10 times. For the remainder of this study, this weight will be referred to as 10 E. M.

In a later publication (2) DeLorme reported that if the number of executions was reduced *from* 70 to 100 executions *to* 20 to 30 executions, far superior results were obtained. The procedure that he recommended at this time is as follows:

First set of 10 executions—Use ½ of 10 E. M.
Second set of 10 executions—Use ¾ of 10 E. M.
Third set of 10 executions—Use 10 E. M.

Numerous studies (3, 4, 7, 8) have been conducted to determine the effectiveness of programs of resistive exercises for the development of muscular strength. The studies cited attempted to determine the number of executions which would most effectively develop strength and/or endurance. In all the studies the conclusion was reached that for the development of muscular strength, those programs that used heavy weights lifted a small number of times proved superior to programs in which light weights were lifted a large number of times.

Hettinger and Muller (5) reported that with static (isometric) contractions, muscular strength increased an average of 5 percent a week when the training load was as little as one-third of the one-execution maximum. The optimum development of strength occurred in static contraction when two-thirds of that weight which could successfully be lifted only once was used. The static-contraction program consisted of exercises in which the subject moved from the starting position to the desired position, held the position for six seconds, and then returned to the starting position.

Procedure

Five boys, who ranged in age from 8 to 16 years, were used as subjects in this study. They were diagnosed as being afflicted with the spastic type of cerebral palsy by R. R. Rembolt, M.D., medical director of the State University of Iowa Hospital School for Severely Handicapped Children. They were all patients in the Hospital School. Two exercise programs (state-contraction and concentric-contraction) were administered to each subject.

Apparatus. In both exercise programs, wall-type pulley weights and an exercise table were used (see Figure I). The subject sat on the edge of the table, with a folded blanket placed under the area immediately superior to the tibiofemoral joint. The pulley rope was attached to the ankle, just superior to the malleoli, passed through a series of pulleys, and attached to the wall weights. Each wall weight weighed 2.25 lbs.

A range-of-motion measuring stand was used at all times during the exercise period to ensure that each subject moved the lower leg through his maximum range of motion; none of the subjects was able to extend the lower leg 180 deg.

Exercise Programs. Both programs were applied to each of the five subjects, one program to each leg. The degree of spasticity of each leg was taken

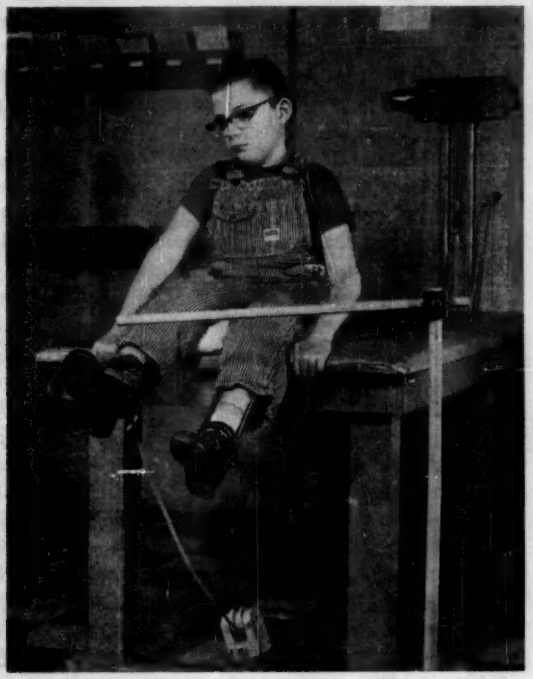

FIGURE I. Patient performing static-contraction exercise described herein.

into consideration. In two subjects the static-contraction program was applied to the more afflicted leg, and in one subject, to the less afflicted leg. In the other two subjects the degree of spasticity of each leg was equal; therefore, in one subject the static-contraction program was applied to the right leg and in the other subject, to the left leg.

Those subjects who normally wore supportive braces performed the exercise program with the braces on in order to gain support in the sitting position and to have the leg stabilized while it was exercised.

Concentric-contraction Program. First, the 10 E. M. for each subject was determined. During each daily session each subject performed 30 executions as follows:

First set of 10 executions—Use ½ of 10 E. M.
Second set of 10 executions—Use ¾ of 10 E. M.
Third set of 10 executions—Use 10 E. M.

A three-minute rest was allowed between one set and the next.

Static-contraction Program. The weight with which the subject could perform a maximum of one execution, carrying the lower leg to maximum extension, was determined. The static-contraction daily program consisted of one lift for which two-thirds of the one-execution maximum was used. This

weight was carried from the starting position to maximum extension, held in this position for six seconds, and then returned to the starting position.

Both programs were administered to the five subjects three times a week for eight weeks. The one- and ten-execution maximums were redetermined after every sixth daily workout.

Testing. Tests to determine the strength of the extensor muscles of the lower leg and the range-of-motion at the tibiofemoral joint were administered to all subjects at the beginning of the eight-week period, after every sixth daily workout, and at the conclusion of the eight-week period.

Strength was tested by placing the subject prone on an exercise table. His lower leg was flexed to 90 deg. A two-inch leather loop was placed around the ankle, just superior to the malleoli. A spring scale was attached to the leather loop and secured at the other end by a chain fastened to the wall. The length of chain was adjusted so that at the moment of maximum contraction, the angle at the tibiofemoral joint was 90 deg., as was the angle of the chain and spring scale to the lower leg. The subject was instructed to extend with maximum effort the lower leg. For each subject, five strength readings were taken, and the highest of these readings was recorded.

Range-of-motion was tested by placing the subject in a sitting position, with his lower legs, in a vertical position, extending over the edge of the exercise table. A goniometer was placed over the tibiofemoral joint, centered just inferior to the lateral condyle of the femur and running along the shafts of the femur and the tibia. The lower leg was slowly extended, and the maximum reading was taken. This was performed five times, and the highest of these readings was recorded.

Analysis

Strength. Both the static-contraction group and the concentric-contraction group had higher strength scores at the end of the program than at the be-

TABLE 1.—STATISTICAL SIGNIFICANCE OF DIFFERENCES BETWEEN MEANS OF STRENGTH (LB.) AND OF RANGE-OF-MOTION (DEG.)

Group	Initial Mean	Final Mean	Mean Gain	Difference between Mean Gains	S.E. of Difference between Means	t*	P
Strength (lbs.)							
Static	34.0	53.0	19.0		5.39	3.52	.04
Concentric	31.8	50.6	18.8		4.14	4.54	.02
				0.2	1.73	0.12	.50
Range-of-Motion (degs.)							
Static	151.0	157.4	6.4		2.20	2.91	.04
Concentric	152.2	157.8	5.6		1.40	4.00	.02
				0.8	2.28	0.35	.50

* A t of 2.78 is required for a P of .05.

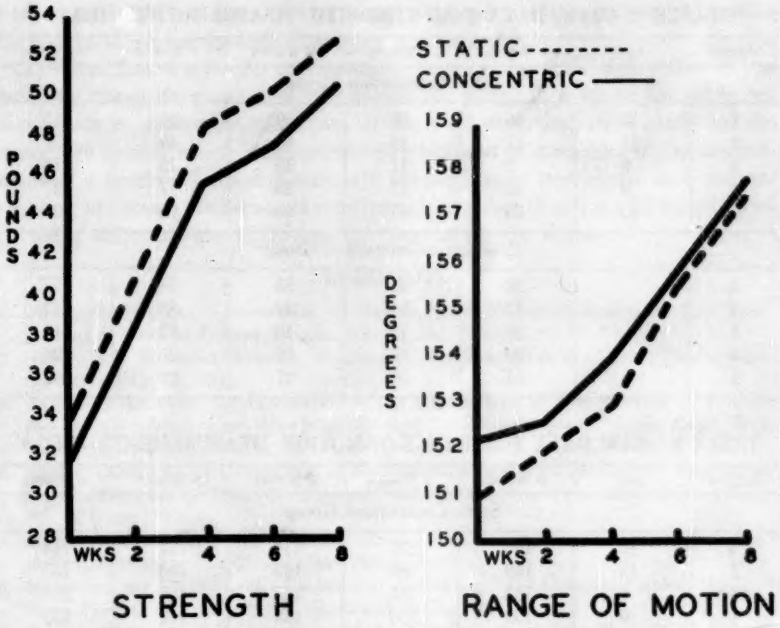

FIGURE II. Bi-weekly mean strength and range of motion scores.

ginning (Table 1 and Figure II). Both the mean gains are statistically significant (probability for static-contraction group = .04, and probability for concentric-contraction group = .02). However, the probability for the difference between the gains is .5; hence the null hypothesis, namely, that the difference could readily have arisen on a chance basis, was retained.

Range of Motion. Both the static-contraction group and the concentric-contraction group had higher range-of-motion scores at the end of the program than at the beginning (Table 1 and Figure II). Both the mean gains are statistically significant (probability for static-contraction group = .04, and probability for concentric-contraction group = .02). However, the probability for the difference between the gains is .5; hence the null hypothesis, namely, that the difference could readily have arisen on a chance basis, was retained.

Graphs for the strength and the range-of-motion scores for the static-contraction group and the concentric-contraction group at the beginning of the program, at the end of two weeks, at the end of four weeks, at the end of six weeks, and at the end of eight weeks appear in Figure II.

The differences between the gains for both strength and range-of-motion when the two methods are compared is not statistically significant. The

TABLE 2.—RAW DATA FOR STRENGTH MEASUREMENTS (LB.)

Subject	Age	0 Weeks	2 Weeks	4 Weeks	6 Weeks	8 Weeks
Static-Contraction Group						
1	12	46	55	59	60	63
2	11	41	42	48	49	52
3	8	7	11	15	18	18
4	9	11	17	24	27	27
5	16	65	81	96	98	105
Concentric-Contraction Group						
1		38	45	55	54	57
2		37	44	49	53	53
3		10	11	16	18	19
4		10	16	22	25	26
5		64	79	87	89	98

TABLE 3.—RAW DATA FOR RANGE-OF-MOTION MEASUREMENTS (DEG.)

Subject	Age	0 Weeks	2 Weeks	4 Weeks	6 Weeks	8 Weeks
Static-Contraction Group						
1	12	130	132	131	134	144
2	11	159	160	164	169	167
3	8	162	161	163	165	167
4	9	152	152	153	152	153
5	16	152	155	154	158	156
Concentric-Contraction Group						
1		139	138	139	137	144
2		155	157	161	166	166
3		164	162	165	166	167
4		153	153	152	154	157
5		150	153	153	156	155

patients in both the static-contraction group and the concentric-contraction group, however, showed statistically significant increases in strength and in range-of-motion over the program period of eight weeks.

Discussion

The factors that influence the physical performance of a handicapped child are difficult to control. Two factors that may have influenced the results of the present study are presented here.

The weight-training programs were applied to separate legs on the same individual. Therefore, the influencing factor of the dominant cerebral hemisphere might have resulted in superior results being obtained for the dominant leg. Since the physical-development curve of handicapped children is not one of a uniformly steady increase when they participate in an intensified physical-rehabilitation program, there is also the possibility that they

had a predisposition to exhibit success in this particular experiment because they were in an accelerated developmental period.

The fact that the results of this study may not be attributed solely to the weight-training program does not negate its value. It remains for other investigators to determine what part of the total contribution is made by the numerous factors which influence the development of strength. If the involvement of a cerebral palsied spastic will permit him to participate in a weight-training program, the author is convinced that strength gains will be achieved by using either static-contractions or concentric-contractions.

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(Submitted 1/31/58)

Selected Factors Associated With Wrestling Success[1]

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Abstract

The purpose of this study was to investigate the relationships among total response times for two wrestling take down maneuvers, a strength test, and initial take down ability. Two response time measures of actual take down maneuvers used in wrestling and the 4-Item Total Proportional Strength Test were secured on 100 Illinois high school varsity wrestlers. These measures were compared to actual competitive initial take down performances based on 1029 individual matches and 815 initial take downs during the 1957-58 season. Wrestlers were divided into successful and unsuccessful groups on the criterion of having won a place in the sectional or state tournament. Significant differences beyond the 5 percent level of confidence in favor of successful wrestlers over unsuccessful wrestlers were found on right grip, left grip, and back lift strength measures. Both groups of wrestlers, however, when compared to three different scoring tables were rated average to below average on all strength measures. There was no significant difference between successful and unsuccessful wrestlers on either of the response time measures. None of the measures secured showed significant correlation with the success criterion of competitive take down ability. It was concluded that (1) strength and response time measures secured in this study were of no value in predicting competitive initial take down ability, and (2) more studies are needed concerning factors suspected of being associated with, and essential to, successful wrestling.

NUMEROUS efforts have been made to examine, identify, and measure factors which seem to play a part in deciding the ultimate level of achievement in motor activities. Such studies have usually analyzed the various components of a skill, devised some means of objectively measuring suspected variables, and then compared the obtained measures to some criterion of success. Investigations have appeared studying many general and specific traits considered to be associated with, and essential to, successful performance in motor activities. One of the more specific elements which has been identified as being of varying importance to success in motor activities is reaction time. Evidence available also suggests not only that the successful execution of an athletic skill involves the ability to react quickly but that the speed with which the movement is made is also important (9, 11, 12).

Wrestling is commonly thought of as an activity in which brute strength is of prime importance and a basic prerequisite for success. Speed of movement and reaction times of wrestlers have been reported as very slow. It has

[1] A research project done at the Physical Education Laboratories of Indiana University under the direction of Dr. Arthur T. Slater-Hammel. Acknowledgment is made to Dr. George Cousins for the use of special apparatus.

also been said that athletes with slow reaction times have a better chance of attaining success in wrestling than in team games (9, p. 154).

Need for the Study

The literature cites the wrestler as characterized by brute strength attributes and endowed constitutionally with a body conducive to such strength, i.e., short-legged, long-trunked, and extremely mesomorphic (10, p. 308). It appears that most such citations are based upon research done on European and professional wrestlers. As discussed in a previous article (10), there are important differences between the European and professional types of wrestling and the style of wrestling conducted in high schools and colleges in the United States. Eriksen (6, p. 568-69) points out this same observation. The two contrasting types of wrestling appear to call for different requirements, and the prerequisite of strength for success in the American type of wrestling may not be of as much importance as reported. A study done on Big Ten wrestlers (10) offered evidence that most of the concepts of a wrestler's physical endowments were seemingly not applicable to the college wrestlers studied. Hence, a study of strength as measured by the 4-Item Total Proportional Strength Test may contribute more information concerning the importance of strength in the style of wrestling found in the selected Illinois high schools studied.

With the exception of a few studies (11, 14, 15), most investigators concerned with the relationship of reaction time and speed of movement to success in motor activities have chosen to secure measures of movements that are quite alien to the actual movements used in the skills being studied. The easiest and most reliable measure obtained has been simple finger reaction time. Pacaud has stated that although relationships do exist among any individual's several reaction times, "It is misleading to speak of a subject's general reaction time, nor is it satisfactory to accept the reaction time of one group of movements as a general motor characteristic of an individual" (12). Thus it seems at least a possibility that the traditional finger reaction time of athletes may not be the best measure for estimating athletic reaction time, since a finger movement is quite alien to any athletic activity. Furthermore, speed of movement or total response time may be of more importance than simple reaction time in investigating athletic skills and skill potential. Bartlett (1) made mention of this principle, stating that a basis for understanding skill or immediate skill potential cannot be gained by studies of isolated function. He called for attention to the over-all response and the need for a complete reorientation of the traditional studies of reaction time.

For the purposes of this investigation, it was felt that a measure of total response time of take down maneuvers actually used by wrestlers would have some advantages over a simple finger reaction time measure. Results of response time measures and a strength test administered were then compared to records of actual competitive take down performances of varsity high school wrestlers over a full season of dual meet competition. In contrast to

other investigations, then, success in the criterion trait was not subjectively evaluated but was an actual measure of success itself.

Definition of Terms

Response time means the time between the presentation of a stimulus and the completion of the entire maneuver.

Drop time means the response time of a wrestler executing a double leg drop (moving forward a short distance and quickly dropping down to both knees).

Jump time means the response time of a wrestler in a standing position suddenly jumping backward with both feet as if to prevent an opponent from securing a hold on his legs.

Take down means: "from a neutral or standing position whenever a contestant brings his opponent to the mat and gains control. . . " (13, p. 61).

Competitive initial take down performance means any one of three indices based on the number of initial take downs secured or lost during the first period of wrestling over a full season of dual meet competition.

Successful wrestler means any wrestler studied who won first or second place at a sectional tournament or who placed in the state meet.

Unsuccessful wrestler means the remainder of the varsity wrestlers not included among the successful wrestlers.

Procedures

Wrestlers from eight Illinois high school teams were used as subjects. The eight teams were selected from schools which had scored points at the state tournament the previous year. Teams from these schools have consistently had good records and could be considered as some of the better teams in the state. Two of the teams had placed first or fourth in the state during the last two seasons. The study was sanctioned and recommended to the selected high schools by the Illinois High School Association. In all, 100 varsity first string or alternate wrestlers were measured. All teams were measured within a two-week period and wrestlers were in a trained state, having practiced approximately six weeks. At the completion of the season official team scorebooks were checked and data recorded concerning the actual competitive initial take down performance of wrestlers during the entire season. Records of 1029 individual matches and 815 initial take downs during the 1957-58 season were realized. No wrestler's take down ability was utilized unless he competed in a minimum of five varsity matches. Ten of the 100 subjects failed to meet this requirement and were dropped from the take down analysis.

The wrestlers were divided into two groups, successful and unsuccessful wrestlers. The successful wrestlers were defined as those who won a first or second place at a sectional tournament or who placed in the state meet. Twenty-four wrestlers, including two state champions, two second, and three third place winners at the state meet, were among the successful wrestlers. The remainder of the varsity wrestlers were classified as unsuccessful, although it should be kept in mind that they probably represented a high caliber of wrestlers.

Experimental Equipment. The experimental equipment used to measure total response times was originally designed and built in the Physical Education

Laboratories of Indiana University under the guidance of Dr. A. T. Slater-Hammel. The main components consisted of a visual stimulus, a response time platform, a remote control unit, and a standard electric clock.

Visual stimulus. The stimulus used was an NE-34 neon glow light mounted in a standard white porcelain lamp socket. The socket was mounted on a 3 x 6 inch board and placed 6 inches in front of the response platform on the floor. The visual stimulus was connected in series with the clock, response time platform, and the experimenter's control switch.

Response time platform. The response time platform was built of a 30 x 30 inch framework of boards 3 inches wide and ½ inch thick. A plywood board 30 x 30 x ¾ inches was mounted on the framework with two 4-inch hinges. A piece of insulite mat covered the top of the platform. At the unhinged end of the framework base a microswitch with a single pole, double throw circuit was attached so that a movement of 1/32 inch activated the switch. Two leads terminating in male plugs were connected to the microswitch, one for the drop time circuit and one for the jump time circuit. Two small wire springs held the plywood top off the switch during the experiment; six sets of these springs were used in rotation during the progress of the experiment.

Remote control unit. A remote control unit was mounted on the experimenter's table alongside the clock. An SPST silent mercury switch was mounted on a 6 x 6 inch plywood panel. The experimenter sat behind the subjects during the course of the experiment.

Standard electric clock. A standard electric clock, Model S-1, was used to record response times. This clock is accurate to the nearest 1/100 second. Since the clock had a 110 volt AC clutch, only one power source was necessary for the entire apparatus.

Test Administration

All testing was done by traveling to the schools and setting up the apparatus in classrooms, coaches' offices, or training rooms where the least amount of distraction would occur. Subjects were tested in pairs. Each subject received 5 practice and 13 actual trials on each response time measure. Instructions were given to both subjects at once. Subject I took his drop time trials while Subject II watched. Subject II then took his drop time trials. After two or three minutes rest, during which time the apparatus was prepared for jump times and instructions given, Subject II took his jump time trials while Subject I watched. Subject I then took his jump time trials. The next pair of subjects started with the jump time measures and a similar rotation followed. By this rotation it was hoped the possible effects of learning and fatigue might be balanced out throughout the entire experiment.

The time interval between a verbal preparatory signal of "Ready" and the presentation of the stimulus was varied throughout the trials. The intervals were arranged in random order of approximately one, two, or three seconds

duration. Three catch trials were randomly assigned to all sets of response measures.

To measure the response time of a subject for the drop maneuver the normally closed setting of the response time platform switch was used. The subject stood 24 inches in back of the platform, flat-footed, and assumed his normal wrestling position. When the light stimulus appeared the clock started. The subject responded by moving forward and dropping down to both knees on a white target line 12 inches from the end of the platform. This total movement of 36 inches was found to be the approximate distance a wrestler moves executing this skill in actual wrestling situations. As soon as the subject dropped on the response platform, the circuit was broken and the clock stopped automatically. Drop times were announced and recorded.

In measuring jump times the normally open setting of the platform switch was used. The subject stood flat-footed on top of the response platform and assumed his normal wrestling position. He was instructed to imagine that an opponent was attempting to secure a hold on his legs when the light appeared. The subject responded by jumping backwards off the platform with both feet. When the subject responded the platform switch was opened, breaking the circuit and stopping the clock. Jump times were announced and recorded.

Both of the maneuvers measured are universally taught in wrestling and both moves or very similar moves are used constantly in actual matches. The wrestlers studied were proficient in the execution of the skills involved.

After each pair of subjects had completed the response time measures, the 4-Item Total Proportional Strength Test was given (4, p. 368-69). This test consists of right grip, left grip, back lift, and leg lift(with belt). Standardized procedures of test administration were followed as outlined by Hunsicker and Montoye (8, p. 53-54).

Test Reliability

Pearson product moment correlations between chance halves and the Spearman-Brown prophecy formula were used to determine the reliability of the response time measures. All estimates were made from raw scores using measures on all 100 subjects. The estimate of reliability for the drop response times was .87 and for the jump response times .81. The dynamometers used had been calibrated at the factory for maximum reliability prior to the testing.

Results

Table 1 presents a summary of the age, height, weight, and wrestling experience of the wrestlers studied. It reveals that the successful wrestlers, on the average, were older, had more years of wrestling experience, and were more advanced in school (approximately three-fourths of a year greater in each item). Inspection of the ranges suggests that wrestling, being conducted by weight classes, affords opportunity for athletic participation to high school

TABLE 1.—SUMMARY OF MEAN AGE, HEIGHT, WEIGHT, AND WRESTLING EXPERIENCE OF 100 ILLINOIS HIGH SCHOOL WRESTLERS

	Age (years)	Height (in.)	Weight (lb.)	Years in School	Years Wrestling
Succ. N = 24	16.75	67.79	147.5	3.5	3.17
Unsucc. N = 76	16.05	67.70	140.7	2.9	2.43
Total N = 100	16.22	67.72	142.3	3.04	2.61
Range	14-19	59-76	85-250	1-4	1-4

boys of all sizes. The successful wrestlers were all juniors and seniors in school. It was also found that the lighter weight classes (95, 103, and 112 lbs.) had the greatest percentage of freshmen and sophomore participants. Beyond these weight classes there appeared to be no set pattern.

Table 2 compares successful and unsuccessful wrestlers on mean strength and weight measures. Statistically significant differences in favor of the successful wrestlers were found on right grip (t=2.07), left grip (t=3.09), and back lift (t=2.50). All differences were significant beyond the 5 percent level of confidence. None of the F values for homogeneity of variance were significant at the 2 percent level of confidence. Differences approaching significance were found on leg lift (t=1.34), Total Proportional Strength (t=1.83), and Strength/Body Weight (t=1.58). Since the *t* between actual

TABLE 2.—SIGNIFICANCE OF DIFFERENCES BETWEEN MEANS OF SUCCESSFUL AND UNSUCCESSFUL WRESTLERS ON STRENGTH AND WEIGHT MEASURES

	Succ. (N = 24)	Unsucc. (N = 76)	t
Actual Weight	M = 147.5	140.7	.84
	σ = 36.6	33.3	
Right Grip	M = 108.2	99.3	2.07*
	σ = 16.9	18.5	
Left Grip	M = 106.5	93.1	3.09*
	σ = 18.1	18.5	
Back Lift	M = 361.0	323.3	2.50*
	σ = 66.6	62.8	
Leg Lift	M = 1023.3	944.1	1.34
	σ = 265.0	282.8	
Total Prop. Strength	M = 1608.0	1459.9	1.83
	σ = 326.9	347.9	
Strength / Body Weight	M = 11.18	10.43	1.58
	σ = 1.85	1.70	

* Significant beyond the 5 percent level of confidence.

mean weights was insignificant (t=.84), it was felt that the two groups could be compared on mean strength measures. Body weight and Total Proportional Strength showed a significant correlation ($r=+.66\pm.057$).

Cureton (4, p. 368-69) has demonstrated the value of the 4-Item Total Proportional Strength Test and the ratio of Total Proportional Strength/Body Weight. Correlations of .414 and .336 were reported by him for Total Proportional Strength with the 14-Item Illinois Motor Fitness Test and the 18-Item Indoor Motor Fitness Test respectively. Dividing Total Proportional Strength by body weight increased these correlations to .517 and .424 respectively.

A scattergram of strength and body weight showed a concave curve upward in a parabolic function similar to the one reported by Cureton (4, p. 371). The point of greatest inflection occurred at about 150-155 pounds, suggesting, again, that the heavier athletes do not realize a proportionate increase in raw strength as weight goes up. The best ratios of strength/body weight occurred between the weights of 120 and 145 pounds, with the heavyweights having the lowest mean ratio (6.33) and the 120-pound wrestlers the highest (11.48).

Although it is reported that beyond the age of 14 years 6 months the effect of age is negligible upon strength, the mean strength measures on grip strengths and back lift for all wrestlers (N=100) when scored on a table for college freshmen (4, p. 385) were all average to below average: right grip, 34 s. s.; left grip, 40 s. s.; and back lift, 52 s. s.

Table 3 shows a comparison between the mean strength measures for all groups of wrestlers studied and a scoring table based on measures of over 100 male college freshmen and sophomores who were not varsity athletes (8, p. 103). Table 3 agrees with the results of a comparison with the college norm table mentioned above. Wrestlers studied rated very poorly on all mean strength measures. Several possible implications are suggested. It may be that wrestlers studied are all average to far below average on mean strength measures or these scoring tables are too high for high school varsity

TABLE 3.—PERCENTILE RANKS OF MEAN STRENGTH MEASURES FOR WRESTLERS SCORED ON A TABLE FOR COLLEGE FRESHMEN AND SOPHOMORES*

	Right Grip	Left Grip	Back Lift	Leg Lift
Successful (N = 24)	6	23	25	53
Unsuccessful (N = 76)	0	6	6	42
Total Group (N = 100)	0.5	8	10	44

* Based on a table in *Applied Tests and Measurements in Physical Education* (8, p. 103).

wrestlers. It is interesting to note that the wrestlers scored much higher on the leg strength measure than they did on grip strengths or back lift.

The right and left grip mean strength measures were also compared to norm tables for grip strengths based on weights and ages applicable to the weights and ages of the wrestlers studied (2). The results again indicated the wrestlers to be only average with ratings of 57 s. s. to 46 s. s., although the ratings were considerably higher than the ones obtained by comparison with college age tables.

Table 4 presents an analysis of the response time measures for both groups of wrestlers studied. There were no significant differences between successful and unsuccessful wrestlers on either of the response time measures obtained. The two response time measures correlated r=.54±.07, which seems moderate in accord with Pacaud's beliefs (12). Correlations between body weight and drop times (r=minus .118±.009) and between body weight and jump times (r=minus .074±.0005) were both statistically insignificant.

Table 5 presents a summary of initial take down ability for successful and unsuccessful wrestlers. Significant differences in favor of the successful wrestlers were found for all take down indices. All differences for t were significant beyond the 5 percent level of confidence. The F test for homo-

TABLE 4.—SIGNIFICANCE OF DIFFERENCES BETWEEN MEANS FOR SUCCESSFUL AND UNSUCCESSFUL WRESTLERS ON RESPONSE TIMES

	Successful (N = 24)	Unsuccessful (N = 76)	t[a]
Drop Time	M = .8595 sec. σ = .0824 sec.	M = .8505 sec. σ = .0906 sec.	.44
Jump Time	M = .4345 sec. σ = .0699 sec.	M = .4318 sec. σ = .0597 sec.	.06

[a] A t of 1.984 required for significance at the 5 percent level of confidence.

TABLE 5.—SIGNIFICANCE OF DIFFERENCES BETWEEN MEANS FOR SUCCESSFUL AND UNSUCCESSFUL WRESTLERS ON INITIAL TAKE DOWN ABILITY

	Successful (N = 24)	Unsuccessful (N = 66)	t
TD[a] Won-Lost 1st Periods	M = .6160 σ = .2652	M = .0156 σ = .3761	7.20[b]
TD Won 1st Periods	M = .7040 σ = .2223	M = .3797 σ = .2218	5.82[b]
TD Lost 1st Periods	M = .0876 σ = .0979	M = .3661 σ = .2138	5.75[b]

[a] TD = take downs.
[b] Significant at 5 percent level of confidence.

geneity of variance for two of the three indices was insignificant at the 2 percent level of confidence. For the take down index of TD Lost/1st periods both t and F were significant.

In order to determine if the two means differed significantly under the condition that the variances differed significantly, an approximation method developed by Cochran and Cox (3, p. 92-93) and described by Edwards (5, p. 273-74) was used. Since the Cochran and Cox procedure is an approximate test, the level of significance was raised from the 5 percent level of confidence to the 1 percent level of confidence. It was found that the two means differed significantly at approximately the 1 percent level of confidence. The observed difference in means was in favor of the successful wrestlers.

Table 5 shows that the successful wrestlers secured the initial take down 70 percent of the time and lost the initial take down only about 9 percent of the time. In the remaining 21 percent of the time no take downs occurred. The unsuccessful wrestlers secured the initial take down about as many times as it was lost (secured 38 percent and lost 37 percent). The results were to be expected since take downs are an important part of successful wrestling.

Initial take downs were chosen as the criterion because the first period of wrestling is the only time equal opportunity for a take down is possible. In all matches both wrestlers start in a neutral position and have equal opportunity for securing a take down. Total number of take downs for an entire match would be a less reliable measure since the number of opportunities would differ greatly depending upon the progress of the match.

Table 6 shows the relationship of the three measures obtained in this study to competitive initial take down ability based upon the all-round index of Take Downs Won-Lost/1st Periods. None of the three measures which were suspected to be of some importance to success in take down wrestling showed any significant correlations with the criterion measure of initial take down ability. All correlations were statistically insignificant and very low.

TABLE 6.—CORRELATIONS OF STRENGTH AND RESPONSE TIME MEASURES TO COMPETITIVE INITIAL TAKE DOWN ABILITY*

	Drop Time	Jump Time	Total Strength / Body Weight
TD Won-Lost / 1st Periods	−.110	−.126	+.084

* Based on 90 wrestlers, 1,029 individual matches, 815 take downs.

Conclusions

Some sources have stated that strength is of great importance to success in wrestling. If the measure of Total Proportional Strength is of any value, the evidence from this study does not give much support to this contention. Although the successful wrestlers show statistically significant differences in

their favor over the unsuccessful wrestlers on three mean strength measures—right grip, left grip, and back lift—the results on the whole are inconclusive. Part of the apparent superiority may be due to the fact that the successful wrestlers were approximately three-fourths of a year older and more experienced than the unsuccessful wrestlers.

The low, insignificant correlation (r=.084) between Total Strength/Body Weight and take down ability suggests that strength is not an important predictor of at least one phase of wrestling ability. Comparison of the mean strength measures of all wrestling groups to three different scoring tables shows general agreement with all scales rating the measures average to below average.

Gross, Griesel, and Stull (7) reported a correlation of .498 between the McCloy Strength Test and ability to learn wrestling based on a study of college men with no previous wrestling experience. Their findings are in direct contrast to the insignificant correlation of Total Proportional Strength/Body Weight with take down ability (r=.084) found in this study. Results of the response time measures show no significant differences between successful and unsuccessful wrestlers.

The results seem to give credence to the feelings of many wrestling coaches who believe that, although strength and speed are naturally desirable in any wrestler, "setting up" an opponent and skillful execution of a continuous series of attempts at take downs are of more importance.

Further investigations concerning other suspected factors contributing to success in wrestling, including better measures of strength and response times, are called for.

Summary

Two response time measures of actual take down maneuvers used in wrestling and the 4-Item Total Proportional Strength Test/Body Weight showed insignificant correlations with competitive initial take down ability of 90 Illinois high school varsity wrestlers calculated on 1029 individual matches and 815 initial take downs during the 1957-58 dual meet season.

Significant differences beyond the 5 percent level of confidence in favor of successful wrestlers over unsuccessful wrestlers were found on mean strength measures of right grip (t=2.07), left grip (t=3.09), and back lift (t=2.50). Differences approaching significance in favor of the successful wrestlers were also found on mean strength measures of leg lift (t=1.34), Total Proportional Strength (t=1.83), and Total Proportional Strength/Body Weight (t=1.58). When mean strength measures were compared to three different norm tables, however, both successful, unsuccessful, and the total group of wrestlers were rated average to below average on all measures of strength.

Further investigations are needed to study factors suspected of being important to success in wrestling, such as endurance, dynamic strength, motor fitness, and other variables.

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Interests of 4000 High School Pupils in Problems of Marriage and Parenthood[1]

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Abstract

This inventory study attempted to ascertain the interests in marriage and parenthood of high school pupils according to year in school, sex, and religion. A total of 4000 students was inventoried. There were 500 boys and 500 girls for each of the four high school years. The sampling was taken from five junior high schools and nine senior high schools in California. The inventory used was prepared by the author and has been used previously to inventory approximately 8000 college and high school students. The results have been compared with those from an equal number of college students to determine what effect age and maturity might have in this area.

EVENTS in the past 50 years have had considerable influence in reducing the age of marriage of American youth. The average marrying age for girls is nearing 20 and for boys, 22.5. A steadily increasing number of our youth marry during the teens. According to Burt (1): "In 1950 there were 109,560 teen age individuals, 14 to 16 years, who were or had been married. In the 17 and 18 year old group there were 457,580 married." Another study (8) states "that 45% of the girls who left high school were either married or soon expected to be married." Estimates in 1957 by the Bureau of Census (9) indicate that about 2.4 percent of the boys and 14.6 percent of the girls between the ages of 14 and 19 in the United States were married.

Since World War II a number of factors have contributed to earlier marriages: the upward trend in business and economic well-being, greatly increased transportation, improved communications, larger Hollywood families, increased educational opportunities, and the wider acceptance and recognition of birth control. These trends have not only resulted in the increase of college marriages; their effect is also evident in the high schools. Most high schools now have several students enrolled who are married, and this number is continually increasing. Because of the many developments during the past 10 years, all evidence indicates that there will be a continued increase in the number of early marriages.

A number of authorities have recognized the problems of marriage and the responsibilities of high schools in relation to married students, and these

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authorities have reported some of their reactions. Kenkel (4) stated that "Iowa high school students are interested in more curricular offerings pertaining to family life education. These students claim through a 'youth opinionaire' that a lack of adequate preparation for marriage and family living is one of the greatest deficiencies in their education." This study also showed that only 11 percent of the secondary schools in Iowa offered some phases of this subject in other courses.

The study by Ivins (3) on student marriages in New Mexico revealed that there has been a minimum tolerance of these early marriages by school officials. Kirkendall (5), in checking with Oregon high schools, "found that there were a number of high school students married, yet a minimal amount of instruction in the subject prevailed."

Reporting on a study of marriage education in California secondary schools, Landis (6) found in 1954 that "90 percent of the 205 senior high schools had had one or more student marriages during the previous year. On a percentage basis, 2.4 percent of sophomore girls, 4 percent of junior girls, and 5.7 percent of senior girls had married. There were 2044 girls and 220 boys who had married, 90.3 percent were girls and 9.7 percent boys." Landis stated that if "family life education is to meet the desired goals of preventing ill advised marriages, then it must be given much earlier in the school curriculum. Some of the materials now offered in courses for seniors would need to be given at the freshman level."

Evidence of the need for family life education is plentiful. Probably 90 percent of all Americans will have married at least once by the time they are 50 years old. It is also estimated that one out of every three or four marriages will end in divorce. Duval and Lewis (2) indicate "that more teen age marriages end in divorce than any other age group." Educators, as well as parents, must develop a more realistic approach to early marriages and their effect on the secondary schools. School administrators, curriculum consultants, boards of education, and others must face the fact that this everyday problem of our society needs early attention. The present emphasis on science, occasioned by the satellites, does not necessarily relieve our schools from meeting the social needs of our youth.

This study should serve as a stimulus to school personnel in isolating the interests and needs of secondary school pupils in the area of marriage. These problem areas, or interest clusters, should be considered in the formulation of a secondary school course of study if such a course is to be meaningful and meet the needs of the student.

Procedure

The inventory used in this study was developed by the author. The same inventory was used to ascertain the interests of college students, which have been reported previously in the *Research Quarterly* (7). Items were selected after an intensive review of such basic literature as textbooks, periodicals,

and course outlines and were reviewed by experts. The inventory has been administered to over 8,000 high school and college students.

In this particular study, students of five junior high schools and nine senior high schools in California were questioned. The schools, including both rural and metropolitan schools, varied in size from 240 to 1850 average daily attendance. Inventories were administered by teachers in all types of classes, and the responses were anonymous. A total of 4000 students were inventoried. There were 500 boys and 500 girls for each of the four high school years. This should be adequate for a representative study.

The raw data were gathered during the 1955-56 and 1956-57 school years. The information was transferred to IBM scoring cards and sorted for analysis and computation. Using IBM scoring cards minimized error and permitted a thorough examination of each item in numerous ways. The items were analyzed according to differences in sex, religion, and year in school and then combined for a composite review.

Validity and Reliability

Validity was established (a) by using an inventory which had previously been tried and proven useful, and (b) by utilizing the many items presently being discussed in the various curriculums.

The reliability of this instrument was previously established with college students by using the split-half method and obtaining a .93 correlation (7). There is a correlation of .905 between the interests of 4000 secondary school students when compared with the interests of 4000 college students.

Analysis of Data

Table 1 is a composite of the relative percent of student interest in each of the 60 items used in this study. The items are arranged according to the percent of intensity in student responses. The range of interest is from 64.1 percent for the item of greatest interest, Living with the Opposite Sex, to 23.1 percent for the item of least interest, Anatomical and Physiological Differences.

The second and third items of greatest interest are Juvenile Delinquency—Prevention with a 63[2] percent response and Normal Sex Relations with a 62 percent response. The fourth and fifth items of greatest response are Demands of the Opposite Sex and Happiness with Home and Family with responses of 62 percent and 60 percent.

The sixth item of interest is Dating, the 60 percent response for which is strongly influenced by the junior high school age group. The seventh item, Pregnancy Problems, 59 percent response, is the most significant item of concern to the girls. The eighth and ninth items, Birth Control Problems and Parent-Child Relationships, both have 55 percent response and are of major importance to the girls. The tenth item of interest, Childbirth, re-

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[2]Percents used in the text have been expressed in the nearest whole number.

TABLE 1.—INTERESTS OF 4,000 HIGH SCHOOL STUDENTS IN PREPARATION FOR MARRIAGE AND PARENTHOOD

No.	Item	Boys %	Girls %	Total %
1	Living With the Opposite Sex	60	68.2	64.1
2	Juvenile Delinquency—Prevention	61.1	64.7	62.9
3	Normal Sex Relations	55.3	68.7	62.1
4	Demands of the Opposite Sex	55.6	67.7	61.7
5	Happiness with Home and Family	50.4	71.9	60.2
6	Dating	58.3	61.2	59.8
7	Pregnancy Problems	45.5	73.3	59.4
8	Birth Control Problems	45.8	64.7	55.3
9	Parent-Child Relationships	45.9	64.5	55.2
10	Childbirth	42.5	67	54.8
11	Religion and Marriage	44.2	64.3	54.3
12	Causes of Divorce	44.8	61.8	53.3
13	Infant Care	39.8	63.9	51.9
14	Protocol, Reception, Honeymoon	42.2	58.5	50.4
15	Responsibilities of Parents	44.5	54.2	50.4
16	Wholesome Attitude toward Marriage	40.4	59.1	49.8
17	Desirable Age for Marriage	41.3	56.8	49.1
18	Controlling Extent of Necking	43.4	54.5	49
19	Engagement Period	36.9	59.3	48.1
20	Advantages of Early Marriage	35	56.1	46.6
21	In-laws and Relatives	35.4	53.6	44.5
22	A College Education	46.8	41.1	44
23	How and Where to Live	42	45.4	43.7
24	Planning and Budgeting	35.7	51.2	43.5
25	Mental Adjustments in Marriage	37.7	53.1	43.4
26	Planning the Wedding	27.4	58.5	42.9
27	Job or Probable Career	48.1	37.1	42.6
28	The Family as a Unit	34.8	48.6	41.7
29	Problems of Mixed Marriages	34.4	47.3	41
30	Health Considerations Before Marriage	32.3	49.1	40.7
31	Physical Adjustments	32.5	47.9	40.2
32	Prenatal Care	28.4	47.4	38.2
33	Basic Dating Rules	36	39.1	37.6
34	Venereal Diseases	38.6	36.4	37.5
35	Life, Auto, Health Insurance	45.3	28.6	37
36	Social Life for Parents	30.1	43.5	36.8
37	Immediate Care of Mother	34.4	37.9	36.2
38	Premarital Counselling	26.8	43.8	35.3
39	Why We All Need Affection	28.6	40.3	34.5
40	Premarital Examination	24	43.3	33.7
41	Marriage While in College	29.4	37.6	33.5
42	Employment Problems	37.0	29.7	33.4
43	Fertility	31.4	35.1	33.3
44	Opportunities for Dating	34.4	32	33.2
45	The Prospective Family	28	38.4	33.2
46	Social Adjustments	28	38.2	33.1
47	Parents and the School	29.4	36	32.7
48	Why People Do Not Marry	28.7	35.8	32.3
49	Adjusting Marital Discord	25.9	36.6	31.3
50	Health Disqualification in Marriage	24.8	34.5	30
51	Significance of Family Background	26.2	33.3	29.8
52	Doctors and Health	27.2	28.7	28
53	Hereditary Characteristics	22.5	33	27.8
54	Infant Mortality and Morbidity	20.3	30.1	27
55	Personality Appraisal	22.9	30.7	26.8
56	Corecreational Activities	22.3	25.7	24
57	Parents, Children and Community	20.5	28.2	24.4
58	Maternal Mortality and Morbidity	20.3	27.1	23.7
59	Chronic and Degenerative Diseases	23.2	24	23.6
60	Anatomical and Physiological Differences	22.1	24.1	23.1

ceived 55 percent of interest responses. The eleventh and twelfth items are Religion and Marriage and Causes of Divorce, with responses of 54 percent and 53 percent. Other items of greatest interest are Infant Care; Protocol, Reception, Honeymoon; and Responsibilities of Parents.

Comparative Interests—Boys and Girls

More girls than boys demonstrate interest in the majority of items in this inventory (see Tables 2 and 3). The girls are extremely interested in Pregnancy Problems, with the high interest rating of 73 percent. This is closely followed by Happiness with Home and Family, 72 percent. They are interested in a cluster of items surrounding questions pertaining to sex, including: Normal Sex Relations, 69 percent; Living with the Opposite Sex, 68 percent; Childbirth, 67 percent; and Birth Control Problems, 65 percent. The girls also demonstrate their interest in Juvenile Delinquency—Prevention; and Parent-Child Relationships, both 65 percent.

The items of interest to the highest percentage of boys are Juvenile Delinquency—Prevention, 61 percent; Living with the Opposite Sex, 60 percent;

TABLE 2.—THE 25 ITEMS IN MARRIAGE AND PARENTHOOD OF GREATEST INTEREST TO 2,000 BOYS

No. Item	% Interested		% Vitally Interested		% Total Interest		Total
	Frosh. Soph.	Jr. Sr.	Frosh. Soph.	Jr. Sr.	Frosh. Soph.	Jr. Sr.	
1. Juvenile Delinquency—Prevention	36.4	44.2	23.2	18.4	59.4	62.6	61.1
2. Living with the Opposite Sex	36.8	46.8	18.6	17.8	55.4	64.6	60
3. Dating	37.8	42.8	23	13	60.8	55.8	58.3
4. Demands of Opposite Sex	29.4	39.4	19.2	23.2	48.6	62.6	55.6
5. Normal Sex Relations	29	39.4	19.2	23	48.2	62.4	55.3
6. Happiness with Home and Family	27.8	35.4	20.8	16.6	46.8	52	50.4
7. Job or Probable Career	31.8	30.4	19.8	14.2	51.6	44.6	48.1
8. A College Education	29.6	33.6	20.8	10.6	50.4	44.2	46.8
9. Parent-Child Relationships	25.8	35.2	14.2	16.6	40	51.8	45.9
10. Birth Control Problems	22.4	36.8	14.8	14.6	43.2	51.4	45.8
11. Pregnancy Problems	20.6	38.4	16.6	15.4	37.2	53.8	45.5
12. Life, Auto, Health Insurance	30	38.4	19.2	10	49.2	48.4	45.3
13. Causes of Divorce	23.4	33.8	15.6	16.8	49	50.6	44.8
14. Responsibilities of Parents	27.2	34.4	14.4	13	51.6	47.4	44.5
15. Religion and Marriage	24.6	34.6	13.8	15.4	38.4	50	44.2
16. Controlling Necking and Petting	25.2	31.8	16	13.8	41.2	45.6	43.4
17. Childbirth	22	34	13.4	15.6	35.4	49.6	42.5
18. Protocol, Reception, Honeymoon	24.6	39	10	10.8	34.6	49.8	42.2
19. How and Where to Live	30	30.2	14.2	9.6	44.2	39.8	42
20. Desirable Age for Marriage	27.6	32.4	11	11.6	38.6	44	41.3
21. Wholesome Attitude toward Marriage	25.8	35.6	11.2	8.2	37	43.8	40.4
22. Infant Care	25	31.2	12	11.4	37	42.6	39.8
23. Venereal Diseases	20.6	30.8	13.6	13.2	34.2	44	38.6
24. Mental Adjustment in Marriage	17.2	34.2	7.4	8.6	24.6	42.8	37.7
25. Employment Problems	23.4	29	13.4	8.2	38.8	37.2	37

TABLE 3.—THE 25 ITEMS IN MARRIAGE AND PARENTHOOD OF GREATEST INTEREST TO 2,000 GIRLS

No.	Item	% Interested		% Vitally Interested		% Total Interest		Total
		Frosh. Soph.	Jr. Sr.	Frosh. Soph.	Jr. Sr.	Frosh. Soph.	Jr. Sr.	
1.	Pregnancy Problems	44	47.8	27.4	27.4	71.4	75.2	73.3
2.	Happiness with Home and Family	38.4	50.4	32.2	22.8	70.6	73.2	71.9
3.	Normal Sex Relations	38	46.2	26	27.2	64	73.4	68.7
4.	Living with Opposite Sex	43.4	42.4	24.2	26.4	67.6	68.8	68.2
5.	Demands of Opposite Sex	36.4	43.6	26.4	29	62.8	72.6	67.7
6.	Childbirth	41.8	46	23.4	22.8	65.2	68.8	67
7.	Juvenile Delinquency—Prevention	39.8	41.4	26.8	21.4	66.6	62.8	64.7
8.	Birth Control Problems	34.8	44.4	24	25.6	58.8	70	64.7
9.	Parent-Child Relationships	40.2	45.2	21.2	22.4	61.4	67.6	64.5
10.	Religion and Marriage	39.8	42	22	21.8	59.8	63.8	64.3
11.	Infant Care	43.8	42.2	24	17.8	67.8	60	63.9
12.	Causes of Divorce	36.6	40.2	23.2	23.6	59.8	63.8	61.8
13.	Dating	45	46.6	18.4	12.4	63.4	59	61.2
14.	Engagement Period	41.8	46	12.8	18	54.6	64	59.3
15.	Wholesome Attitude toward Marriage	41	46	16.8	14.4	57.8	60.4	59.1
16.	Protocol, Reception, Honeymoon	37.2	40.2	19	20.6	56.2	60.8	58.5
17.	Planning the Wedding	38.8	39.8	17.8	20.6	56.6	50.4	58.5
18.	Desirable Age for Marriage	41.4	40.2	16	16	57.4	56.2	56.8
19.	Advantages of Early Marriage	35.4	40.4	15.2	21.2	50.6	61.6	56.1
20.	Controlling Necking and Petting	30.8	36.8	21.8	19.6	52.6	56.4	54.5
21.	Responsibilities of Parents	36.6	37	18.6	16.2	55.2	53.2	54.2
22.	In-laws and Relatives	32.4	39.4	11.4	14	43.8	53.4	53.6
23.	Mental Adjustments in Marriage	34	41.8	13.8	16.6	47.8	58.4	53.1
24.	Planning and Budgeting	38.8	40.2	17.8	14.8	56.6	55	51.2
25.	Health Considerations before Marriage	32.4	34.2	12	9.6	44.4	43.8	49.1

and Dating, 58 percent. These are followed by Demands of the Opposite Sex, 56 percent; Normal Sex Relations, 55 percent; Happiness with Home and Family, 50 percent; The Job or Probable Career, 48 percent; and A College Education, 47 percent.

Although there are differences between the interests of boys and of girls, the similarities are striking. Seven among the top ten items for boys and girls are the same. On Tables 2 and 3, which present the 25 top items for boys and for girls, there are only six items on each table which do not appear on the other. The items among the top 25 for girls but not for boys relate to engagement, wedding, and budget. The items on the boys' table which do not appear on the girls' table are chiefly concerned with problems relating to supporting a family. One of these items, How and Where to Live, though lower in rank order for girls than for boys, is actually checked by a larger percentage of girls than boys. On another item, Employment Problems, there is only a 2 percent difference between boys and girls.

TABLE 4.—THE TEN ITEMS IN PREPARATION FOR MARRIAGE AND PARENTHOOD OF LEAST INTEREST TO 2,000 HIGH SCHOOL GIRLS

No.	Item	% Interested		% Vitally Interested		% Total Interest		Total
		Frosh. Soph.	Jr. Sr.	Frosh. Soph.	Jr. Sr.	Frosh. Soph.	Jr. Sr.	2000
1.	Chronic and Degenerative Disease	16.8	29.2	6.4	10	23.2	39.2	24
2.	Anatomical and Physiological Differences	15.4	21.4	5	6.4	20.4	27.8	24.1
3.	Corecreational Activities	18.8	23.2	3.4	6	22.2	29.2	25.7
4.	Maternal Mortality and Morbidity	15.6	23.2	8.4	7	24	30.2	27.1
5.	Parents, Children and Community	22.8	20.8	6.4	6.4	29.2	27.2	28.2
6.	Life, Auto and Health Insurance	20.4	22.6	8	6.2	28.4	28.8	28.6
7.	Doctors and Health	22.2	21.8	6.6	6.8	28.8	28.6	28.7
8.	Employment Problems	22.6	24.6	5.8	6.4	28.4	31	29.7
9.	Infant Morbidity and Mortality	17.8	27.2	8.2	8.6	26	35.8	30.1
10.	Personality Appraisal	22.4	26.2	6.6	6.2	29	32.4	30.7

TABLE 5.—THE TEN ITEMS IN PREPARATION FOR MARRIAGE AND PARENTHOOD OF LEAST INTEREST TO 2,000 HIGH SCHOOL BOYS

No.	Item	% Interested		% Vitally Interested		% Total Interest		Total
		Frosh. Soph.	Jr. Sr.	Frosh. Soph.	Jr. Sr.	Frosh. Soph.	Jr. Sr.	2000
1.	Infant Mortality and Morbidity	12.4	22.2	5.	8.	17.4	30.2	20.3
2.	Maternal Mortality and Morbidity	9.6	19.	6.8	6.2	16.4	25.2	20.3
3.	Parents, Children and Community	16.4	15.2	5.6	3.8	22	19	20.5
4.	Anatomical and Physiological Differences	11.2	24.8	3.2	5	14.4	29.8	22.1
5.	Corecreational Activities	13.8	19.4	6.4	5	20.2	24.4	22.3
6.	Hereditary Characteristics	12.8	18.2	7.8	6.2	20.6	24.4	22.5
7.	Personality Appraisal	11.8	20.6	7.6	5.8	19.4	26.4	22.9
8.	Chronic and Degenerative Disease	10.4	20.8	8	7.2	18.4	28	23.2
9.	Premarital Examination	13.4	23.4	5.8	6.8	19.2	30.2	24
10.	Health Disqualification in Marriage	15.2	21.6	8	4.8	23.2	26.4	24.8

Freshmen and Sophomore Boys vs. Junior and Senior Boys

It is clearly evident that a high percentage of the junior and senior boys indicate interest in most items. On 18 of the 25 items of greatest interest, a high percentage of upper class boys indicate interest; however, more freshmen and sophomore boys indicate vital interest on 16 of the 25 items. Of the items of a high interest rating, a greater percentage of freshmen and sophomore boys have interests in problems of Dating, Normal Sex Relations, Job or Probable Career, and A College Education. This may indicate challenges and experiences not yet satisfied and areas in which a need for wholesome information is definitely indicated.

Freshmen and Sophomore Girls vs. Junior and Senior Girls

In relation to most items, more junior-senior girls than freshmen-sophomore girls are interested, by a 3-to-1 ratio. A higher percentage of freshmen-sophomore girls have interest in Juvenile Delinquency—Prevention, Infant Care, Dating, and Planning the Wedding.

TABLE 6.—REACTIONS OF STUDENTS, WHEN GROUPED ACCORDING TO RELIGIOUS BELIEFS, TO THE 25 ITEMS OF GREATEST INTEREST

No.	Item	Protestant		Catholic		Jewish		Other		Total
		M	F	M	F	M	F	M	F	4000
1.	Living with the Opposite Sex	34.4	36.9	10.2	20.4	1.	.8	14.9	10.2	64.1
2.	Juvenile Delinquency—Prevention	35.1	35	12.1	19.5	1.	.8	13	9.4	62.9
3.	Normal Sex Relations	31.1	39.3	10.6	19.3	1.	.9	12.9	8.9	62.1
4.	Demands of Opposite Sex	31.9	37.6	10.9	19.8	.8	.9	12.2	9.4	61.7
5.	Happiness with Home and Family	27.7	39.7	11.1	20.9	.7	.7	11.8	10.6	60.2
6.	Dating	31.8	33.9	12.3	18.1	.9	.7	13	8.5	59.8
7.	Pregnancy Problems	25.9	39.9	8.7	21.5	.5	.6	10.4	10.3	59.4
8.	Birth Control Problems	22.6	35.8	10.7	18.2	.7	1.1	10.2	9.3	55.3
9.	Parent-Child Relationship	25.1	36	10.3	18.1	.7	.9	9.8	9.5	55.2
10.	Childbirth	23.3	37.4	9	19.8	.4	.8	9.8	9	54.8
11.	Religion and Marriage	24.3	33.6	11	19.9	.6	.6	8.3	8.7	54.3
12.	Causes of Divorce	26.6	34.5	9.9	17.6	.6	.8	8.7	8.9	53.3
13.	Infant Care	20.7	34.5	8.8	19.4	.6	.7	9.7	9.3	51.9
14.	Protocol, Reception, Honeymoon	22.7	33.5	9.9	16	.4	.5	9.2	8.5	50.4
15.	Responsibilities of Parents	24.6	29.3	8.6	16.2	.5	.3	10.8	8.2	50.4
16.	Wholesome Attitude Toward Marriage	23.5	32.9	7.7	16.8	.4	.6	8.8	8.8	49.8
17.	Desirable Age for Marriage	22.9	31.4	8.8	15	.4	.7	9.3	8.7	49.1
18.	Controlling Necking and Petting	23.7	31.6	9.1	14.4	.7	.8	9.6	7.7	49
19.	Engagement Period	20.8	32.4	7.5	16.8	.6	.7	8	9.4	48.1
20.	Advantages of Early Marriage	20	31.3	7.2	15.3	.6	.6	7.2	8.9	46.6
21.	In-laws and Relatives	20.2	26.6	6.9	15.1	.7	.4	7.6	7	44.5
22.	A College Education	28.4	25.1	7.9	10.1	1.2	.5	9.3	5.4	44
23.	How and Where to Live	22.5	24.2	7.6	13.7	.2	.4	10.5	6.9	43.7
24.	Planning and Budgeting	19.2	28.6	7.5	14.7	.6	.4	8.4	7.5	43.5
25.	Mental Adjustment in Marriage	18.9	30.5	6.8	14.5	.7	.8	6.3	7.3	43.4

Religion

Religion is usually considered by most adults to be an important factor in daily living. Students responding to this inventory did not demonstrate any clear-cut patterns of intensity of interest in relation to religious differences. This study considered only public school children, and there could be basic religious differences if parochial school students were inventoried. Table 4 presents the items of greatest interest in relation to religious affiliations.

High School vs. College Students

The study (7) conducted several years ago on the same number of college students makes possible some very interesting comparisons. Of the first 25

items of interest, 20 were identical to both the high school and college groups. It is worth noting that of the first 15 items of greatest interest to men and boys, 13 of the items were identical. This clearly indicates that the interests of both men and boys are quite specific, consistent, and dependable. The intensity of interests, however, varies.

When comparing interests of college girls and high school girls, it is found that 11 of the first 15 items are identical. When further comparisons are made, it is found that of the items of interest to the fewest girls, three out of five are identical to both groups.

Conclusions

1. The interest problems of high school students relative to marriage relationships can be measured.
2. The interest of high school students in marriage and parenthood is significant.
3. The items of greatest interest follow a pattern according to sex; however, the interests for both sexes are quite similar.
4. On the whole, girls indicate a greater percent of interests than do boys.
5. The greatest interest of boys is in Juvenile Delinquency—Prevention while for girls it is in Pregnancy Problems.
6. Girls demonstrate an over-all mean percentage of interest of about 46 percent as compared to 34 percent for the boys, indicating about a 35 percent greater over-all interest for the girls.
7. Percent of interest is not altered significantly by religious belief.

Recommendations

1. High school pupils are interested in marriage and parenthood and should be challenged by the development of appropriate courses.
2. Coeducational classes, for wholesome discussion of items of interest to both sexes, should be organized.
3. Religious differences should not be of great concern when developing curriculums in this area.
4. Since there is a demonstrated interest, the high schools should feel morally obligated to include the area of marriage in their curriculum offerings.

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Analytical Study of School Health Service Practices in the United States

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Abstract

The purpose of this study was: (a) to analyze and compare the school health practices in three separate census groupings using random sampling techniques where necessary; (b) to show by an analysis of the options separately for each census group what differences there are, if any, in school health service practices in communities of varying sizes; and (c) to show what different practices are related to different plans of administration of the school health services. On the basis of the criticisms of 15 experts from the areas of medicine, health education, and public health, an inquiry form was developed with 61 categories and 620 options arranged under six major divisions.

IT IS GENERALLY recognized that the school health program is an essential unit of the total educational program, but it is surprising how little is known of what is being done in this area. Educators have the challenging task of using all available professional health resources to promote and maintain optimum health of the children entrusted to them. According to the outstanding leaders in the field, there are changes in the health problems of school-age children, and consequently school health procedures need to be adapted to these changing conditions.

The completion of this investigation required: (a) the construction of a preliminary inquiry form from a complete list of possible school health services and administrative practices; (b) the evaluation of school health service practices listed and described on the preliminary inquiry form by a jury of experts; (c) the development of a final inquiry form based upon the preliminary form, using the revisions suggested by the jurors; (d) the distribution of the final inquiry form to selected administrators of school health services of city schools in three separate United States census groupings throughout the country; (e) the analysis of data to get a definitive summary of what health practices actually are in existence; (f) a comparison of school health practices by census groupings; and (g) an evaluation of health practices under various administrative organizations.

Definition of Terms

School Health Services. "It is the purpose of school health services to: (a) appraise the health status of pupils and school personnel; (b) counsel pupils, parents, and other

persons involved concerning appraisal findings; (c) encourage the correction of remedial defects; (d) help plan for the health, care and education of the handicapped child; (e) help prevent and control diseases; and (f) provide emergency care for the sick or injured" (1).

Item. A category used throughout the inquiry form to ascertain the extent to which the selected cities subscribe to the practices recommended by the jury.

Option. One or more choices of a school health service or administrative practice listed under each item used to execute the school health service program.

Review of Related Literature

A review of the research revealed few studies related in purpose and method to the one presented here. The indexed literature did not reveal any studies concerned with school health service practices and administrative policies done with the degree of completeness here.

The National Education Association and the American Medical Association prepared a document (3) to provide clear comprehensive statements of specific school health policies which directly or indirectly affect the health of the pupils. The document is concerned with four aspects of school health services, namely: (a) determination of health needs; (b) follow-up and interpretation; (c) care for emergency sickness or injury; and (d) communicable disease prevention and control. Kilander (2) in 1950 prepared a bulletin showing the status of many phases of school health services in cities having a population of 2500 or more in Continental United States.

Research Procedure

The securing of data for this study depended upon the development of an inquiry form for the analysis of school health service practices and administrative policies in the United States in three separate census groupings. In order to develop major items and options for the inquiry form, a list of 63 items and 488 options of school health services and administrative practices was compiled and tabulated under six major divisions that might be in existence in school health areas of city school systems. The sources utilized for the compilation included: (a) previous studies of school health service practices; (b) books and articles pertaining to school health services and administrative practices; (c) contributions from various teachers, physicians, professors, public health officials, nurses, and health educators; and (d) assistance obtained from persons attending national and state health conferences and from the national and state education and health organizations.

The next steps in the development of the inquiry form were to prepare the six divisions of the form, select headings for the 63 items, and select words and phrases for the 488 options.

The evaluation of the school health service and administrative practices required the development of criteria in the form of a special instrument and its critical evaluation by a group of experts. To obtain jury validation, five experts from the field of health education, five public health experts, and

five medical experts co-operated in evaluating the items and options on the instrument for school health services and administrative practices.

The final inquiry form consisted of 61 items and 620 options of school health service and administrative practices, properly assigned under six major parts. The refinement of the original instrument decreased the number of items from 63 to 61 and increased the number of options from 488 to 620.

The next step in the investigation procedure was the selection of the cities for the study. The following stratified random sampling techniques were used.

1. From a table of random numbers, using the first four numbers of the set, a number was taken and placed on the upper right corner of an index card. The numbers were taken in order as they appeared on the table. There were 1071 numbers used.

2. Using the same index card, a code number of a city was placed on the left corner. These code numbers were those assigned to the cities in the reference, *Statistics of City School Systems.* All cities within the population groups selected for this study were used. Because the city school systems which are a part of a county-unit were not included in this reference, it was necessary to obtain the rest of the cities needed to complete the population groupings from the *World Almanac.*

3. For the population group I, as determined by the United States Census classification, all of the 82 cities within the population range of 100,000 to 499,999 were listed on cards according to code, city, state, and superintendent (38). Group II of the United States census classification required the use of 253 index cards. Group III of the United States census classification required the use of 736 index cards.[1]

4. The index cards were placed in numerical order of the random numbers in groups II and III. The first 150 cards in each group were selected and listed according to code, city, state, and superintendent.

5. A preliminary letter, with a return self-addressed card, was sent to the superintendent of the 382 cities, seeking their co-operation.

6. A goal of 250 was set. To ensure this number, a second sampling was necessary when it was apparent that all of the original sampling were not able to assist with the study. Two hundred additional preliminary letters were sent to superintendents in selected areas, making a total of 582. The value of the whole study depended upon the extent to which the sample could be representative of the country as a whole, and so the additional names were chosen by the original procedure.

A follow-up letter was sent to the superintendents of the original sampling, asking their assistance in returning the card signifying their intentions to assist or not assist with the study. The total number of replies from popula-

[1]Population Groups: Group I—100,000 to 499,999; Group II—30,000 to 99,999; Group III—10,000 to 29,999.

tion group I was 64 or 79.0 percent. The total number of replies from the original sampling of population group II was 116 or 77.3 percent. The total number of replies from the original sampling of population group III was 109 or 72.6 percent.

When the superintendents or administrators of school health service programs in the city school system agreed to co-operate in the study, a copy of the final inquiry form, with an enclosed stamped self-addressed envelope, was sent to the designated official. One month later a follow-up letter was sent to those who had not yet returned the inquiry form. At the end of another six-week period, the objective was reached. Forty-eight inquiry forms from population group I, 102 from population group II, and 100 from population group III were received.

The completed forms were organized according to population groups I, II, and III. The information on each inquiry form was transferred to a specially devised answer sheet in order to obtain item counts by means of the graphic item analysis attachment of the IBM test scoring machine.

Findings

The percentages listed beside the options on the inquiry form are usually more or less than 100 percent, because the item, in most instances, requested the person giving the information to check more than one option when possible, or the situations varied according to the respective grade level within the city, or the option was not checked at all by some communities involved in the study. Table 1 shows the number of cities in each population group under the three plans of administration. In reading the percentage responses under the three plans of administration, these totals should be kept in mind.

TABLE 1.—NUMBER OF CITIES IN EACH ADMINISTRATIVE GROUP

Population	Administrative Groups Number of Cities		
	Bd. Educ.	Bd. Health	Jointly
Group I	32	5	11
Group II	78	13	11
Group III	76	6	18
Totals	186	24	40

Table 2 shows that the largest percentage of all three population groups have the provision for the school health service program in the over-all budget of the local community board of education. There is no disagreement of any magnitude.

The population groups are not consistent regarding who is charged with the responsibility of directing and co-ordinating the school health services

TABLE 2.—ORGANIZATION AND ADMINISTRATION

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
1.	In whose over-all budget is the provision made for school health services? Check (V) one.								
	a. Local community board of education	65	75	76	94	95	97	0	28
	b. Local community board of health	10	11	6	6	0	0	79	10
	c. Local education department for larger unit (county, regional, etc.)	0	4	3	0	5	3	0	2
	d. Local board of health for larger unit (county, regional, etc.)	–	–	–	–	–	–	–	–
	e. Jointly	23	10	18	0	0	0	0	70
	f. Other (Specify)	10	5	5	12	3	3	8	12
2.	What is charged with the responsibility of directing and co-ordinating the school health services throughout the system? Check (V) one.								
	a. Supt. of Schools	28	24	50	6	23	57	21	25
	b. Asst. Supt. of Schools	8	10	7	12	10	7	8	5
	c. School Medical Advisor	29	14	12	41	17	13	8	2
	d. School health co-ordi-na tor or consultant	19	25	5	12	22	4	25	25
	e. School nurse	8	12	39	6	12	39	21	22
	f. Other Specify Supervisor of Health, Physical Education and Safety, Dir. of Health Services, Director of Pupil Personnel, Supervisor of Nurses, School Health Co-ordinator and Director of Health Dept. Health Officer and School Medical Advisor	31	37	23	19	35	14	50	50
3.	What is the specific title of the person charged with the responsibility of co-ordinating the school health services throughout the system?								

TABLE 2.—*Concluded*

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
	a. (Specify) Director Pupil Personnel ____ Dir. Health Services, Dir. Pupil Services, Dir. Bureau Health Ed., Co-ord. Health Services, Consultant in Health, Supervisor Public Health Nurses, Dir. Dept. Child Health	90	89	81	91	90	82	79	88
4.	To whom is the health coordinator or administrator (by whatever title) responsible? Check (V) one.								
	a. Supt. of Schools ____	88	85	79	94	90	86	46	80
	b. Dir. of Pub. Health ____	6	6	4	0	1	0	29	12
	c. Jointly ____	0	4	8	0	3	3	12	12
	d. Other (Specify) ____	10	11	6	6	10	8	21	2
5.	How are the (1) school health services, (2) physical education and (3) health instruction co-ordinated? Check (V) one.								
	a. The three programs are under one administrative head ____	40	34	43	31	32	49	33	42
	b. The three programs operate independently ____	29	40	43	34	37	43	46	35
	c. The director or co-ordinator of number ___ is responsible for or supervises the other two ____	8	9	6	9	12	4	0	10
	d. Other (Specify) Local School Health Coord. ____ Dir. of Health and Phys. Ed. consults with Dir. of Health Services, Phys. Ed. under School Dept. and Health Instruction and Health Services under Health Dept., Cooperative relationship under Asst. Supt. of Schols	27	24	15	28	28	12	25	15

TABLE 3.—PROFESSIONAL PERSONNEL, RECORDS, MEDICAL EXAMINATIONS

Item No.	Items and Options Under Each	Percentage of Responses by															
		Census Population Group Only						Administrative Organization: Board of Ed. by Census Group						Bd. of Health		Jointly	
		I		II		III		I		II		III					
		F	P	F	P	F	P	F	P	F	P	F	P	F	P	F	P*
1.	Indicate the number and kind of professional personnel available to the school by checking the appropriate columns																
	Personnel																
	a. School Medical Advisor	48	20	12	38	49	49	53	50	21	55	11	57	29	12	18	30
	b. Pub. Health Physician	17	7	9	23	29	26	9	9	3	23	1	24	21	33	32	50
	c. School Nurse	79	75	82	6	12	17	97	6	87	9	91	18	50	12	45	15
	d. Public Health Nurse	17	8	16	12	14	16	3	3	5	9	8	9	17	33	42	32
	e. Visiting Nurse	6	4	6	..	5	5	6	..	4	3	8	5	8	12	..	2
	f. School Dentist	12	9	4	46	34	34	16	50	6	36	4	37	8	21	10	35
	g. Pub. Health Dentist	10	3	2	15	12	11	9	6	1	9	..	9	8	25	10	20
	h. School Dental Hygienist	29	33	26	2	4	6	28	3	38	5	30	7	21	..	18	2
	i. Pub. Health Dental Hygienist	6	4	3	6	5	4	3	..	3	4	3	4	8	8	8	10
	j. Psychologist	67	50	30	17	18	28	72	9	50	19	30	28	33	17	52	28
	k. Psychiatrist	4	2	2	29	22	18	3	28	3	19	..	16	14	12	5	38
	l. Technician for vision testing	27	17	11	4	11	9	19	..	15	8	9	4	25	8	25	28
	m. Opthalmologist as consultant	4	4	2	21	12	9	6	28	5	13	1	11	4	4	..	8
	n. Family Physician	6	5	8	4	8	12	6	3	6	8	8	12	4	4	5	12
	o. Family Dentist	4	6	7	6	6	13	3	6	6	5	7	12	4	8	8	12
	p. School Health Co-ordinator	33	31	8	4	6	4	28	3	31	4	8	5	29	..	25	10
	q. Speech and Hearing Therapist	67	75	35	4	8	23	66	3	77	5	32	22	58	8	65	22
	r. Others (Specify) Audiometrist, Super. of nurses, Occupational therapist, Lip reading specialist, School medical director, School adjustment counselor, Part-time dental assistants, Psychiatric social worker.	29	25	10	15	15	7	31	19	27	15	9	7	17	12	20	8
2.	Who is responsible for planning and constructing the health record card in respect to content and format? Check (V) one or more.																

* F for full-time, p for part-time.

TABLE 3.—*Continued*

Item No.	Items and Options Under Each	Percentage of Responses by											
		Census Population Group Only						Administrative Organization: Board of Ed. by Census Group				Bd. of Health	Jointly
		I		II		III		I		II		III			
		F	P	F	P	F	P	F	P	F	P	F	P	F	P*
	a. Members of staff of Bd. of Ed.	17		23		32		6		18		26		54	35
	b. Members of staff of Bd. of Health	12		23		34		6		15		28		50	40
	c. School health co-ordinator	25		25		8		31		29		8		8	12
	d. School Med. Advisor	40		27		15		59		36		13		8	15
	e. Local building principal	8		10		7		9		10		5		8	10
	f. Supt. of Schools	17		14		27		16		15		26		4	28
	g. Asst. Supt. of Schools	19		11		5		22		14		7		–	5
	h. School nurse	44		39		39		53		50		45		8	20
	i. Physical Ed. Super.	21		5		9		16		6		7		12	15
	j. Guidance Director	8		8		6		9		9		5		8	5
	k. Clerk	2		–		3		3		–		4		–	–
	l. Other (Specify) Committee of school medical advisor with public health and school personnel. School nurse supervisor, Director of school health and nurse supervisor. Committee of school people and health service personnel. Cooperative effort health council.	21		26		10		16		24		8		21	30
3.	Who is responsible in your school system for supervising the care of the health record cards in respect to their order, completeness and availability for use by all of the school staff? Check (V) one.														
	a. School health co-ordinator	6		6		3		–		6		3		4	10
	b. School nurse	71		71		78		88		73		84		67	48
	c. Building principal	29		23		17		22		23		11		21	40
	d. Teacher	10		16		13		6		17		11		21	15
	e. Health teacher	6		–		2		3		–		–		12	2
	f. Phys. Ed. instructor	4		–		1		–		–		1		4	2
	g. Other (Specify)	2		11		7		–		9		7		8	12
4.	When does the child's formal health record begin? Check (V) one.														

TABLE 3.—*Continued*

Item No.	Items and Options Under Each	Percentage of Responses by											
		Census Population Group Only						Administrative Organization					
								Board of Ed. by Census Group				Bd. of Health	Jointly
		I		II		III		I		II		III			
		F	P	F	P	F	P	F	P	F	P	F	P	F	P*
	a. None	–		–		1		–		–		1		–	–
	b. Kindergarten	73		73		50		75		76		62		54	55
	c. At grade one and preschool	27		29		44		25		27		37		50	45
5.	Is the child's formal health record cumulative? Check (V) one.														
	a. Yes kindergarten thru 12	79		69		52		81		72		58		54	52
	b. Yes grades 1-9 inclusive	2		6		6		–		3		5		21	5
	c. Yes grades 1-12 inclusive	17		24		41		16		24		38		21	38
	d. No	–		2		–		–		1		–		–	2
	e. Other (Specify)	2		2		4		3		3		–		12	2
6.	What members of the school staff have free access to pupil's health record? Check (V) one or more.														
	a. Administrators	92		93		86		91		94		88		79	92
	b. Guidance counselor	90		81		70		91		81		74		62	82
	c. Teacher	96		89		88		94		86		89		88	98
	d. Nurse	96		97		93		100		97		97		79	92
	e. School medical advisor	77		64		62		88		64		66		50	60
	f. Health teacher	69		52		47		62		49		50		46	65
	g. Other (Specify)	8		20		12		12		19		11		17	12
7.	How many periodic general medical examinations, including preschool examination, if any, are required of each pupil while he is enrolled in school? Check (V) one.														
	a. At entrance to school	46		48		57		44		49		52		54	58
	b. At specific grade levels. (Which? ____)	67		53		57		59		53		59		62	58
	c. By teacher referral	38		44		42		28		44		38		38	60
	d. Other (Specify) K, 4-7-10	31		32		31		38		31		34		29	25

TABLE 3.—*Continued*

Item No.	Items and Options Under Each	Percentage of Responses by													
		Census Population Group Only						Administrative Organization							
								Board of Ed. by Census Group						Bd. of Health	Jointly
		I		II		III		I		II		III			
		F	P	F	P	F	P	F	P	F	P	F	P	F P	F P*
		Section A—Elementary													
8.	Where is the periodic general medical examination given?														
	Location														
	a. First aid room	–		–		–		–		–		–		–	–
	b. Physician's office in the school	4		13		10		..		12		11		12	12
	c. Private physician's office	8		6		4		6		6		5		4	5
	d. Physician's office at Bd. of Health Center	25		35		19		16		36		12		33	42
	e. Local clinic	4		5		3		6		3		..		8	10
	f. Nurse's office	33		22		20		41		27		25		12	5
	g. School health room	62		38		48		66		37		50		46	45
	h. Other (Specify)	12		10		16		12		8		14		21	15
		Section B—Junior High													
8.	Where is the periodic general medical examination given?														
	Location														
	a. First aid room	–		–		–		–		–		–		–	–
	b. Physician's office in the school	4		7		9		..		8		11		..	10
	c. Private physician's office	4		5		3		..		5		4		4	5
	d. Physician's office at Bd. of Health Center	27		27		13		19		26		8		29	38
	e. Local clinic	2		4		..		3		3		..		8	..
	f. Nurse's office	29		17		25		34		21		29		17	8
	g. School health room	50		31		32		47		31		32		42	38
	h. Other (Specify)	6		12		10		6		10		9		17	10
		Section C—Senior High													
8.	Where is the periodic general medical examination given?														
	Location														
	a. First aid room	–		–		–		–		–		–		–	–
	b. Physician's office in the school	4		7		8		3		8		9		..	8
	c. Private physician's office	6		9		3		3		10		4		4	5
	d. Physician's office at Bd. of Health Center	25		27		12		16		27		9		25	32

TABLE 3.—*Concluded*

Item No.	Items and Options Under Each	Percentage of Responses by													
		Census Population Group Only						Administrative Organization							
								Board of Ed. by Census Group						Bd. of Health	Jointly
		I		II		III		I		II		III			
		F	P	F	P	F	P	F	P	F	P	F	P	F	P*
	e. Local clinic	2		3		1		3		3		–		4	2
	f. Nurse's office	31		19		26		38		21		29		25	10
	g. School health room	52		30		35		50		28		34		50	38
	h. Other (Specify)	6		15		11		6		–		11		21	10
9.	Is the school nursing service provided as part of: Check (V) one.														
	a. a generalized public health nursing service?	25		18		15		3		5		3		58	60
	b. a specialized school nursing service?	71		71		75		97		86		88		29	22
	c. a combination of a and b?	10		8		11		–		5		5		12	32
	d. visiting nurse plan?	–		3		–		–		4		–		–	–
	e. some other plan? (Specify)	4		4		4		3		4		3		8	5

throughout the system. Population group I prefers the school medical adviser. Population group II recognizes the assignment for the school health co-ordinator or consultant, and group III records the greatest percentage in favor of the superintendent of schools.

The title of the person charged with the responsibility of co-ordinating the school health services throughout the system is recognized by all groups as essential and one title was unanimously agreed upon, as Table 2 shows.

The health co-ordinator or administrator (by whatever title) is responsible in most cases to the superintendent of schools, with little or no variation in any of the three population groups.

There appears to be no consistent pattern of co-ordinating the school health services, physical education, and health instruction. The three population groups are about equally divided between having the three programs under one administrative head and having them operate independently.

Table 3 presents the number and kind of professional personnel by population group. Appreciable variations exist among the three population groups as to the individuals or groups responsible for planning and constructing the health record card in respect to content and format.

Supervision of the health record cards (in respect to their order, completeness, and availability for use by all of the school staff) is usually a job for the nurse, in all three population groups.

TABLE 4.—MEDICAL EXAMINATIONS

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
1.	On what basis are medical examinations scheduled? Check (V) one.								
	a. Referral examinations	21	27	31	22	28	29	25	30
	b. Periodic examinations	29	31	35	28	33	42	25	20
	3. Combination of a and b	58	48	47	53	47	46	54	55
	d. Other (Specify)	8	6	7	9	4	4	17	10
2.	Who gives the medical examination? Check (V) one.								
	a. School Medical Advisor	50	45	48	66	56	62	12	8
	b. Public Health Physician	21	17	17	6	8	8	46	48
	c. Family Physician	58	65	44	47	64	37	71	70
	d. Other (Specify)	23	17	19	28	13	16	21	28
	Yearly appointment of local physician. Clinics employing the school medical advisor when the family physician is not available or when the children can't afford to pay. A physician employed by the hour. Family physician checking those children needing attention.								
3.	Who assists the physician at the time of the medical examination? Check (V) one or more.								
	a. School nurse	69	66	74	91	71	80	46	45
	b. Public Health Nurse	21	14	18	3	6	5	38	58
	c. Representative from Visiting Nurse Organization	–	–	1	–	–	1	–	–
	d. Teacher	31	10	16	28	6	13	21	30
	e. Principal	4	9	7	3	9	8	4	8
	f. Physical education instructor	10	5	7	9	4	5	8	12
	g. Clerical assistance	–	10	7	–	12	5	4	8
	h. Representative from P.T.A.	12	17	19	9	15	16	12	30

TABLE 4.—*Continued*

Item No.	Items and Options Under Each	Percentage of Responses by Census Population Group Only I	II	III	Administrative Organization: Board of Ed. by Census Group I	II	III	Bd. of Health	Jointly
	i. Other (Specify) ____ Staff of family physician. Family physician's nurse.	10	22	17	6	23	16	12	22
4.	Indicate the average amount of time provided for the physician's examination. Check (V) one.								
	a. About 10 minutes ____	50	37	37	47	36	38	50	38
	b. Not more than 15 minutes ____	15	9	19	16	8	21	4	18
	c. 15-20 minutes, with more time when findings indicate the need ____	21	22	24	19	22	20	29	28
	d. Other (Specify) ____ The time varies.	15	27	15	16	29	16	25	10
5.	From whom, other than the child, does the child's health information come? Check (V) one or more.								
	a. Parent or guardian ____	100	91	95	100	91	95	96	90
	b. Family physician ____	71	73	84	72	78	62	58	65
	c. Teacher ____	77	66	86	78	71	62	58	70
	d. Guidance personnel ____	56	31	30	56	35	29	21	42
	e. Physical education supervisor ____	25	25	25	19	28	26	17	28
	f. Older brother or sister ____	21	12	16	28	13	13	4	20
	g. Other (Specify) ____	4	9	4	6	8	5	–	8
6.	Indicate by a check (V) approximately what percentage of children are accompanied by one or both parents:								
	a. At the initial entrance examination in the elementary schools? ____								
	(1) 5% ____	8	9	19	9	8	22	8	10
	(2) 5-14% ____	6	8	4	6	9	1	8	8
	(3) 15-49% ____	15	6	12	19	5	11	4	15
	(4) 50-100% ____	60	48	46	53	47	46	54	55

TABLE 4.—*Concluded*

Item No.	Items and Options Under Each	Percentage of Responses by													
		Census Population Group Only						Administrative Organization							
								Board of Ed. by Census Group						Bd. of Health	Jointly
		I		II		III		I		II		III			
	b. At subsequent examinations in the elementary schools?														
	(1) 5%	31		30		43		34		29		49		25	30
	(2) 5-14%	19		9		7		16		10		9		–	12
	(3) 15-49%	17		8		11		19		8		11		12	10
	(4) 50-100%	15		16		7		6		14		1		25	25
		B	G	B	G	B	G	B	G	B	G	B	G	B G	B G*
		Elementary Schools													
7.	Indicate by checking the appropriate columns to what extent clothing is removed during a general medical examination.														
	a. Outer clothing removed only	4	10	13	11	13	18	3	12	14	12	17	22	4 4	5 8
	b. Stripped to waist with shoes and stockings removed	58	44	33	26	57	44	59	47	36	28	58	42	33 29	50 38
	c. Entirely stripped with drapes	4	6	6	6	9	9	6	6	8	8	9	9	4 4	2 5
	d. Clothing removed depending upon physician's findings	25	29	20	18	18	17	22	28	15	13	17	17	29 29	28 25
	e. Other (Specify)	12	6	18	20	4	5	16	6	17	19	5	7	12 17	8 5
		Secondary Schools													
7.	Same as above.														
	a. Outer clothing removed only	6	21	9	19	5	18	3	25	9	21	7	21	4 8	8 12
	b. Stripped to waist with shoes and stockings removed	46	21	26	16	45	25	56	22	27	17	49	25	38 25	22 15
	c. Entirely stripped with drapes	8	8	7	5	8	8	9	6	8	6	9	9	– –	8 8
	d. Clothing removed depending upon physician's findings	27	38	18	20	20	24	19	38	13	15	21	26	33 33	28 25
	e. Other (Specify)	4	4	18	18	3	8	3	3	19	19	4	9	4 8	8 8
8.	Indicate the approximate number of years the present plan of administering school health service program has been used. Check (√) one.														
	a. 1-5 years	19		11		20		12		9		17		29	22
	b. 5-10 years	19		26		24		19		26		24		25	25
	c. 10 years or more	60		54		51		66		60		55		38	40
	d. Other (Specify)	2		4		3		–		3		3		8	5

* B for boys, G for girls.

TABLE 5.—HEALTH RECORDS

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
1.	Check (V) the following points of information found on the child's health record card:								
	a. Name	98	98	99	97	99	99	96	100
	b. Address	98	97	98	97	97	97	96	100
	c. Family physician	69	81	77	62	77	78	88	82
	d. Sex	96	94	97	97	94	96	96	98
	e. Father's name	90	87	99	88	86	99	92	98
	f. Mother's maden name	67	62	76	62	62	71	67	82
	g. Person to be called in emergency	67	64	64	69	64	67	54	62
	h. Child living with guardian	69	80	80	62	82	79	71	85
	i. Home telephone number	79	81	78	81	83	75	75	82
	j. Family dentist	31	34	34	31	27	36	50	35
	k. Brothers or sisters	50	41	41	50	38	41	46	48
	l. Others living with family	19	21	21	16	19	21	25	22
	m. Race	54	41	52	56	37	53	42	58
	n. Marital status of family	38	36	44	41	35	46	21	48
	o. Birth place	60	49	73	50	35	74	54	75
	p. Mother's occupation	52	49	56	44	42	58	54	68
	q. Fathers' occupation	54	57	64	50	53	63	58	72
	r. Economic status of family	12	12	15	12	13	17	..	15
	s. Father's nationality	29	19	31	28	19	36	17	22
	t. Second responsible party	23	17	21	25	17	25	12	15
	u. Business address of father or mother	46	42	46	50	41	45	25	58
	v. Permission to send child to physician of family's choice if parent can't be reached	33	35	45	28	35	49	24	45
	w. Other (Specify)	15	24	22	19	24	24	12	18
	Special emergency card.								
	Special health problems.								
2.	Information concerning immunization and diagnostic tests is collected for which of the following? Check (V) one or more.								
	a. Diphtheria	96	93	96	94	94	97	88	98
	b. Schick test	52	50	66	56	56	66	46	48

TABLE 5.—*Continued*

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
	c. Booster for diphtheria	81	84	89	81	85	88	83	88
	d. Smallpox	94	93	92	94	94	93	88	92
	e. Whooping cough	83	85	86	84	85	87	83	85
	f. Booster D.W.T.	60	71	75	56	69	74	75	75
	g. Tetanus toxoid or serum	67	65	69	59	65	70	62	72
	h. Tuberculin test	67	67	78	72	68	82	62	62
	i. Chest X-ray for students over 15	69	64	64	72	65	66	58	60
	j. Typhoid fever	44	53	50	41	33	51	29	50
	k. Urinalysis	19	20	20	16	17	21	21	25
	l. Hemoglobin	12	14	9	12	10	9	17	15
	m. Serology	2	2	3	3	3	4	–	–
	n. Poliomyelitis — Salk vaccine	73	78	86	81	77	87	79	75
	o. Immunization reaction	33	33	39	38	33	38	21	42
	p. Other (Specify)	6	14	9	6	17	9	4	8
3.	Which of the following factors of medical and health history are recorded on the child's health card? Check (V) one or more.								
	(1) Rheumatic fever	98	90	88	97	95	92	79	82
	(2) Tuberculosis	94	82	89	94	86	91	79	82
	(3) Heart trouble	90	85	88	94	90	91	75	78
	(4) Allergy	62	67	72	66	71	75	75	48
	(5) Measles	88	86	90	88	92	93	75	78
	(6) German measles	65	74	77	69	82	78	58	60
	(7) Asthma and hay fever	73	70	72	84	74	76	58	52
	(8) Whooping cough	94	87	91	94	92	92	79	85
	(9) Mumps	85	83	90	91	90	92	75	72
	(10) Frequency of colds	48	48	59	47	51	57	50	52
	(11) Frequency of sore throats	52	42	53	56	44	51	42	50
	(12) Tuberculosis contact	62	55	61	69	54	63	62	50
	(13) Poliomyelitis	88	82	85	88	86	89	75	75
	(14) Diabetes	67	64	63	75	64	67	62	50
	(15) Scarlet fever	85	82	84	81	86	89	71	78
	(16) Surgical operations	77	75	77	81	78	82	67	62
	(17) Ear infection	71	71	76	78	72	79	62	65
	(18) Running ear	58	49	64	66	54	66	38	50
	(19) Chorea	54	51	55	62	55	59	46	35
	(20) Serious injuries	75	67	70	75	68	72	62	68
	(21) Chickenpox	75	75	81	84	83	88	54	55
	(22) Diphtheria	83	83	85	81	88	91	71	72

TABLE 5.—*Continued*

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
	(23) Pneumonia	69	68	79	69	73	83	62	60
	(24) Prolonged illness	50	51	58	56	54	58	46	48
	(25) Birth injuries	44	35	50	50	35	50	42	40
	(26) Meningitis	58	44	57	62	51	61	33	38
	(27) Intestinal parasitis	19	19	37	22	18	37	25	22
	(28) Skin infection	54	50	57	62	58	59	33	38
	(29) Smallpox	69	68	75	69	68	75	67	68
	(30) Mental illness-emotional	42	35	50	41	37	49	38	42
	(31) Influenza	23	28	43	22	31	46	21	30
	(32) Nutritional deficiency diseases	35	42	51	34	47	53	29	40
	(33) Syphilis	27	15	33	28	17	33	25	20
	(34) Onset of menses	8	11	27	6	14	28	12	12
	(35) Epilepsy	75	59	64	81	63	67	46	60
	(36) Typhoid fever	54	46	54	53	51	55	42	48
	(37) Dizziness	31	24	33	25	24	30	33	35
	(38) Fainting spells	48	33	44	44	37	43	42	38
	(39) Frequent pains in legs and joints	31	30	42	34	33	39	33	32
	(40) Frequent nose bleeds	38	31	49	41	36	47	33	35
	(41) Persistent cough	38	25	37	38	28	34	33	32
	(42) Constant fatigue	33	27	40	34	29	36	38	35
	(43) Tonsillitis	62	55	63	66	54	67	62	50
	(44) Headaches	42	34	49	44	38	46	33	42
	(45) Rupture	60	51	63	69	54	66	54	42
	(46) Convulsions	62	49	59	62	50	59	67	48
	(47) Others (Specify)								
	Malaria	12	34	38	19	36	39	25	22
	Infectious Hepatitis								
4.	Indicate which of the following medical factors are considered in the health examination by checking (V) one or more items.								
	a. Skin and scalp	100	89	91	97	91	95	79	90
	b. Mouth and throat	100	88	93	97	90	95	83	92
	c. Breathing through mouth	81	65	79	81	65	84	58	72
	d. General dental	100	80	89	97	83	88	79	90
	e. Heart	98	82	90	94	82	92	83	90
	f. Pulse	60	53	66	53	54	67	46	70
	g. Blood pressure	52	35	44	53	38	46	29	42
	h. Lymph glands	83	67	69	84	71	70	50	72

TABLE 5.—*Continued*

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
	i. Endocrine glands	65	44	43	69	49	42	29	50
	j. Lungs	92	75	88	94	79	88	71	82
	k. Abdomen	77	52	68	78	56	67	42	70
	l. Hernia	83	68	80	81	71	82	67	75
	m. Genitalia	50	38	54	50	40	58	33	48
	n. Orthopedic	83	67	70	88	65	75	62	68
	o. Nervous system	67	48	56	66	51	59	46	48
	p. Speech	81	61	69	84	65	75	54	52
	q. Psychosomatic reactions	31	20	24	38	22	25	21	18
	r. Eyes—vision	76	81	85	100	88	86	71	78
	s. Ears—hearing	98	79	86	97	86	88	71	78
	t. Others (Specify)	4	14	17	6	14	16	8	15
5.	Indicate which of the following physical factors are considered in the health examination by checking (V) one or more items.								
	a. Height	98	91	95	97	92	93	96	95
	b. Weight	98	91	95	97	92	93	96	95
	c. Body type	44	33	48	53	35	53	33	30
	d. Feet	90	68	80	94	69	83	71	70
	e. General appearance	81	68	80	81	67	80	62	82
	f. Nutrition	92	85	81	88	87	84	75	82
	g. Posture	98	86	87	94	87	92	79	85
	h. Color perception	33	25	28	25	28	30	21	28
	i. Others (Specify)	2	6	1	3	8	1	–	–
6.	Indicate which of the following miscellaneous items are considered in the health record by checking (V) one or more.								
	a. Summary of doctor's findings and recommendations	98	79	87	94	77	88	88	90
	b. Summary of dentist's findings and recommendations	79	61	57	81	59	62	62	58
	c. Results of laboratory tests	44	26	36	47	23	36	21	48
	d. Parents present at examination	62	40	41	69	37	38	38	58
	e. Need for special education	48	52	43	56	53	42	33	50

TABLE 5.—*Continued*

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
	f. Referrals to family physician	83	79	77	88	78	80	71	78
	g. Others (Specify)	10	6	3	19	5	3	8	2
7.	For which of the following aspects of the program is the teacher responsible for making observations, including the necessary records. Check (V) one or more.								
	a. Eyes—vision	62	61	57	56	59	53	62	72
	b. Ears—hearing	62	49	52	59	47	50	50	65
	c. Emotional adjustment	73	76	75	75	76	76	58	82
	d. Nervousness, restlessness	79	76	74	75	77	72	62	88
	e. Speech defect	77	75	79	75	76	78	62	88
	f. General appearance	37	76	64	75	77	61	62	80
	g. Excessive use of lavatory	75	77	66	72	77	67	62	80
	h. Nail biting	79	71	66	78	69	66	62	80
	i. Personal hygiene	81	75	69	81	74	71	67	78
	j. Shyness	73	68	59	69	68	58	54	78
	k. Twitching movements	71	73	65	72	73	66	58	72
	l. Cooperation	67	64	57	62	64	61	46	68
	m. Food habits	50	49	48	44	49	47	46	58
	n. Mental attitude	71	75	62	66	72	63	67	75
	o. Leadership	56	57	52	50	60	54	38	60
	p. Sleep habits	38	42	37	31	41	41	38	40
	q. Personality, character	56	67	55	50	65	58	50	68
	r. Elimination habits	29	31	29	25	28	30	29	38
	s. Hair and scalp	58	58	53	50	58	51	46	72
	t. Skin	60	63	59	53	67	59	33	75
	u. Thumb sucking	65	67	57	62	68	58	54	65
	v. Fatigue	71	67	61	72	65	62	54	72
	w. Behavior, conduct, deportment	75	75	70	75	73	70	62	82
	x. Body alignment	35	35	37	25	32	38	38	48
	y. Growth record	35	44	45	28	42	41	33	68
	z. Frequent complaints of gastro-intestinal disturbances	42	41	43	44	40	45	38	42
	A. Muscular coordination	71	65	56	69	67	59	46	62
	B. Others (Specify) Teachers refer child to nurse but do not record on health card.	4	25	23	6	26	28	8	12

TABLE 5.—*Continued*

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
8.	Which of the following items of information are recorded on the child's health record card? Check (V) one or more.								
	a. Absence due to illness record	50	43	39	50	42	37	42	50
	b. Extra curricular activities	10	13	19	9	9	17	12	28
	c. Physical tests and achievement record	27	20	34	25	21	37	17	28
	d. Athletic eligibility	38	29	22	44	28	25	29	20
	e. Intelligence tests	25	18	26	22	18	26	17	28
	f. Pupil's employment record	15	8	12	19	8	12	8	10
	g. Hobbies, club membership	10	8	13	9	8	12	8	18
	h. Future plans	12	5	10	12	4	8	12	12
	i. Obvious dental defects	92	79	74	88	78	78	75	80
	j. Obvious orthopedic defects	90	81	77	91	81	82	67	78
	k. Mouth breathing	62	61	65	72	59	70	62	50
	l. Frequent headaches	58	61	61	62	58	63	62	55
	m. Frequent colds	58	63	59	62	56	62	75	55
	n. Physical education classification	40	26	15	47	28	16	21	18
	o. Chronic constipation	31	21	17	25	23	18	21	20
	p. Acne	60	60	58	69	62	63	46	48
	q. Usual amount of sleep	15	11	12	16	10	14	12	8
	r. Diet	25	23	17	25	26	16	25	18
	s. Social interests	10	4	13	12	4	12	8	10
	t. Intimacy with parents	10	3	8	12	4	9	8	–
	u. Others (Specify)	2	13	16	3	13	17	4	12
	(1) By whom entered: Nurse by the majority of cities, also teacher, physician, personnel in health service office.								
9.	a. When remedial work is corrected on the advice of the school, is there any place made for recording it on the health card? Check one.								
	(1) Yes	92	82	87	91	82	86	92	88
	(2) No	4	13	9	6	14	12	4	2

TABLE 5.—*Concluded*

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization: Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
	b. Who actually records the information on the card in terms of information obtained from remedial specialist himself? Check one.								
	(1) Teacher	19	26	26	–	27	17	33	50
	(2) School nurse	83	76	78	94	78	83	67	65
	(3) Clerk	2	9	7	3	9	8	8	2
	(4) Guidance personnel	–	4	1	–	3	–	4	5
	(5) Director of School Health	–	–	5	–	–	4	4	2
	(6) Other (Specify)	4	10	4	3	8	1	4	12

Table 4 indicates that all population groups give strong recognition to the practice of basing the child's medical examination on a combination of the periodic examination and the referral examination. Population groups I and II have the family physician attend to the periodic general medical examination. A greater percentage of communities in group III use the services of the school medical adviser for this school health service. Groups I and II also recognize the school medical adviser as an important member of the health service program.

In all three population groups, the school nurse is the key person to assist the physician at the time of the medical examination. In some communities throughout the country, however, the public health nurse, the teacher, and a representative from the parent-teacher association assist at this time.

The average amount of time used for this periodic general medical examination by the majority of the cities is about ten minutes.

Table 5 shows that all of the items and options listed on the inquiry form appear to be a part of the standard health record card.

It is important to note that the teacher plays a vital role in assuming responsibility for making observations of the school child as well as for making the necessary records in all of the cities.

All of the participating cities agreed that it was important to record the results of all remedial work that has been attended to at the request of the school health service personnel.

Table 6 clearly shows that all of the cities participating in this study agree that any school official should have access to the pupil's health record card. The teacher, public health nurse, school nurse, and the parent were also recognized as individuals who should have the opportunity to view the card.

TABLE 6.—CUMULATIVE HEALTH RECORDS

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
	Section A—Elementary								
1.	Location of pupil's cumulative health record at the various school levels.								
	a. General administrative office of the school system	6	10	10	3	9	11	21	5
	b. Individual school office	40	34	33	34	35	30	29	48
	c. Guidance office	2	2	1	–	3	1	–	2
	d. Health dept. office	4	9	14	6	10	13	12	5
	e. Separate file under supervision of the nurse	33	32	25	41	37	28	21	15
	f. General cumulative folder in administrative office	2	11	8	3	8	7	8	15
	g. Other (Specify) Teacher's desk at elementary level.	27	24	24	28	21	24	17	35
	Section B—Junior High								
1.	Location of pupil's cumulative health record at the various school levels.								
	a. General administrative office of the school system	8	9	11	6	8	9	17	12
	b. Individual school office	27	30	32	33	22	28	25	40
	c. Guidance office	10	9	1	6	8	–	8	12
	d. Health dept. office	8	10	15	6	10	17	12	8
	e. Separate file under supervision of the nurse	38	33	23	47	40	26	17	12
	f. General cumulative folder in administrative office	2	9	9	–	8	9	4	12
	g. Other (Specify) Teacher's desk at elementary level.	8	11	12	9	5	12	17	18
	Section C—Senior High								
1.	Location of pupil's cumulative health record at the various school levels.								
	a. General administrative office of the school sys-								

TABLE 6.—*Concluded*

Item No.	Items and Options Under Each	Percentage of Responses by: Group Only Census Population I	II	III	Administrative Organization: Board of Ed. by Census Group I	II	III	Bd. of Health	Jointly
	tem	10	10	9	6	9	8	17	12
	b. Individual school office	29	25	25	25	26	20	25	38
	c. Guidance office	10	9	9	9	9	8	8	12
	d. Health dept. office	8	11	14	6	12	16	12	8
	e. Separate file under supervision of the nurse	42	40	27	53	46	29	25	18
	f. General cumulative folder in administrative office	4	9	10	3	9	11	_	12
	g. Other (Specify) Teacher's desk at elementary level.	10	8	11	9	3	11	12	15
2.	Who, in addition to the school health service coordinator and/or nurse, has access to the child's health record? Check (V) one or more.								
	a. Any school official	73	76	75	81	74	74	71	78
	b. Teacher	69	78	80	69	76	80	75	82
	c. Others (Specify) Public health nurse, school nurse, parents	19	17	11	19	19	14	8	8

TABLE 7.—HEARING EXAMINATION

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
1.	Indicate the test used in your school system to detect hearing loss. Check (V) one.								
	a. Group pure-tone audiometer	44	41	32	31	38	28	50	55
	b. Individual pure-tone sweep check	69	74	70	84	82	71	50	52
	c. Whisper test	12	6	6	6	5	5	12	12
	d. Western Electric Numbers Test screening	8	7	5	6	9	7	4	2
	e. Other (Specify)	15	5	14	19	4	14	12	10
2.	Who is responsible for giving the hearing test? Check (V) one.								
	a. School nurse	46	55	75	59	68	86	21	28
	b. Visiting nurse	6	1	4	3	–	3	8	8
	c. Teacher trained in the techniques of testing	12	10	4	12	9	3	12	10
	d. Phys. Ed. instructor	4	1	1	–	–	1	4	5
	e. Health teacher	2	–	–	–	–	–	–	2
	f. Technician trained in use of machines	17	22	12	9	18	5	21	40
	g. Speech and hearing therapist	19	25	12	19	29	12	17	12
	h. School audiometrist	19	9	3	19	6	1	8	18
	i. Other (Specify) Follow-up on referrals by an audiogram. Volunteers trained by the nurse. Health department audiometrist.	12	13	10	16	6	7	29	18

The individual puretone sweep check test is the instrument used for the purpose of checking the hearing of the students in the greatest number of the cities by all population groups. The percentage distributions are listed in Table 7.

The nurse is the person responsible for giving this screening test for hearing in the majority of the communities.

The majority of the cities in all three population groups use the Snellen Eye Chart for the purpose of giving the visual screening test in their school

health service program. The Massachusetts Vision Test is used in some of the school systems in all three groups, as Table 8 shows.

The school nurse received the greatest percentage recognition by all of the participating cities as the member of the school health service personnel who attends to this visual screening test.

TABLE 8.—VISUAL SCREENING TEST

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
1.	Indicate what test is used for the visual screening test. Check (V) one.								
	a. Snellen Eye Chart	81	74	71	88	81	71	50	70
	b. Massachusetts Vision Test	25	31	25	16	27	25	50	30
	c. Keystone Telebinocular Test	17	19	22	9	23	21	21	18
	d. Bosch and Lomb Ortho-Rater Test	4	2	2	6	3	3	–	–
	e. Other (Specify) American Optical Co. Sight Screener, Plus Sphere Lens, Atlantic City Vision Test	10	10	13	12	9	14	8	10
2.	Who gives the visual screening test? Check (V) one.								
	a. School medical advisor	4	4	9	3	5	11	–	2
	b. Pub. Health Physician	–	1	2	–	–	3	4	–
	c. School nurse	71	68	72	84	78	78	33	50
	d. Teacher	33	27	17	16	24	14	42	32
	e. Physical education instructor	6	6	4	3	5	4	4	8
	f. Health teacher	2	2	2	–	1	1	4	5
	g. Trained technicians	12	19	9	6	17	5	17	30
	h. Other (Specify)	14	16	16	19	13	8	25	28

None of the options concerned with the routine dental examination received outstanding percentage recognition, as Table 9 shows. There is no appreciable percentage variation between use of the school dentist and the family dentist.

Three members of the health service personnel received considerable percentage recognition by the groups, showing that the schools depend upon the school nurse, public health nurse, school medical adviser, and teacher to make routine dental inspection.

TABLE 9.—DENTAL INSPECTION

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
1.	Which of the following make routine dental inspection? Check (√) one.								
	a. School dentist	42	36	30	47	35	32	38	25
	b. Dental hygienist	19	33	27	19	36	29	25	20
	c. Family dentist	35	22	24	34	22	21	17	38
	d. Other (Specify) School nurse, Public health nurse, School medical advisor, Teacher.	25	23	24	22	22	24	25	28
2.	How many dental inspections are required of each child while he is enrolled in school? Check (√) one.								
	a. None	17	20	22	12	17	18	33	28
	b. Specify number Yearly inspection Three inspections Two inspections Yearly during elementary grades	69	74	69	72	76	75	54	62
3.	If routine dental inspections are made by a private dentist what provisions are made for those not so inspected? Check (√) one.								
	a. School dentist	25	16	17	25	18	18	8	20
	b. Pub. Health dentist	10	2	6	6	1	4	17	8
	c. Dental hygienist	10	8	15	12	10	16	4	8
	d. Dental clinic	23	8	9	22	9	9	8	12
	e. Other (Specify) Loan fund used by private dentist. Board of education employs dentist for annual inspection. Screening done by local dental society. Inspection given at time of periodic general medical examination. Dentists assisting on voluntary basis. Financial aid available from social agencies.	17	25	19	19	27	16	17	22

TABLE 10.—PROCEDURES FOLLOWED IN MAKING REFERRALS IN THE SCHOOL HEALTH SERVICE PROGRAM

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization: Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
1.	By whom is the parent informed concerning the outcome of the examination? Check (√) one or more.								
	a. Teacher	17	23	21	12	19	16	33	35
	b. Nurse	96	88	87	97	88	91	83	82
	c. Principal	27	23	15	19	22	13	29	22
	d. Health co-ordinator	4	4	2	–	4	3	–	8
	e. Health teacher	4	1	2	–	–	3	4	5
	f. Physical education instructor	–	5	2	–	6	1	–	20
	g. Guidance counselor	8	4	2	12	3	–	–	10
	h. School medical advisor	27	17	9	34	17	9	12	12
	i. Other (Specify)	8	10	4	3	13	5	–	8
2.	Who is responsible for recommending referral of the pupil for further diagnosis or treatment when serious deficiency or health problems are discovered? Check (√) one or more.								
	a. School medical advisor	58	40	32	69	45	38	29	20
	b. Parents	12	9	18	12	6	12	29	20
	c. Teacher	12	14	23	–	9	20	29	35
	d. Nurse	77	49	62	78	81	66	54	72
	e. Health service co-ordinator	–	5	3	–	4	4	4	2
	f. Principal	15	18	17	6	15	14	12	35
	g. Other (Specify)	6	3	10	9	3	8	8	8
		Section A—Elementary							
3.	Personnel who reminds students of medical appointments to insure their presence at correct time and date.								
	a. No systematic plan	10	11	14	3	9	16	17	15
	b. Principal	12	17	12	9	15	13	17	15
	c. Nurse	54	57	42	66	65	43	25	38
	d. Teacher	38	33	34	38	35	30	21	48
	e. Parents	17	19	19	22	17	17	25	18
	f. Other (Specify)	2	5	9	3	5	11	4	2

TABLE 10.—*Continued*

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization: Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
		Section B—Junior High							
3.	Same as above.								
	a. No systematic plan	10	11	13	3	8	14	17	18
	b. Principal	4	12	12	3	12	12	12	10
	c. Nurse	54	50	39	62	58	42	21	35
	d. Teacher	23	21	25	19	23	25	17	25
	e. Parents	17	15	16	22	13	16	17	15
	f. Other (Specify)	2	7	9	_	8	11	8	2
		Section C—Senior High							
3.	Same as above.								
	a. No systematic plan	10	13	15	3	10	17	17	18
	b. Principal	4	10	13	3	9	13	12	10
	c. Nurse	56	51	39	75	58	43	21	30
	d. Teacher	29	18	25	28	22	22	21	22
	e. Parents	17	13	17	22	10	16	17	18
	f. Other (Specify)	2	7	9	_	8	11	8	2
4.	Indicate who excludes pupils from school when they manifest suspicious symptoms of a communicable disease. (Check (V) one.								
	a. School medical advisor	19	16	17	22	18	21	8	5
	b. Pub. health physician	6	3	6	6	1	4	4	12
	c. School nurse	44	61	64	50	71	70	38	32
	d. Pub. health nurse	12	7	8	_	5	3	12	30
	e. Teacher	12	16	15	9	14	17	12	18
	f. Principal	71	68	50	69	65	51	62	65
	g. Other (Specify)	4	6	12	6	4	12	4	12
5.	What readmission policies are used by your school system for pupils who have been excluded on suspicion of communicable diseases? Check (V) one.								
	a. Medical certificate from school medical advisor	15	13	16	16	12	20	17	8
	b. Certificate from school nurse	17	26	29	19	28	32	29	12
	c. Note from parent	8	16	15	9	14	17	17	10
	d. Judgment of teacher or principal	23	23	14	25	23	14	17	18

TABLE 10.—*Concluded*

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
	e. Certificate from member of Pub. Health Department	35	38	20	38	37	18	25	38
	f. Medical certificate from family physician	65	54	61	66	55	61	62	55
	g. Certificate from public health nurse	15	7	9	3	6	5	12	25
	h. Other (Specify)	10	18	10	12	18	12	8	10
6.	To what agency may a mentally or emotionally disturbed child be referred? Check (V) one or more.								
	a. State Department Mental Health Clinic	17	19	41	22	23	45	17	12
	b. Local child guidance clinic	77	56	39	78	54	39	58	55
	c. Local Division of Maternal and Child Health	6	3	2	6	3	1	4	5
	d. State department of Education	6	2	4	9	3	4	4	–
	e. No such service available	–	3	5	–	4	7	–	–
	f. Family physician	46	29	40	47	28	42	29	40
	g. Psychiatrist	50	24	18	50	26	18	25	25
	h. Psychologist	62	33	34	62	33	38	25	42
	i. Private foundation	6	10	2	9	10	3	–	5
	j. Others (Specify) Family service organizations. Local mental health clinics. School adjustment counselors. School counselors. School social workers. Central school guidance center. Visiting counselors and teachers.	23	22	15	19	21	16	17	25

TABLE 11.—PROCEDURES USED IN PROVIDING A FOLLOW-UP PROGRAM

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
1.	What provisions are made for follow-up services? Check (V) one.								
	a. Regularly for every student when the need is indicated	79	78	71	81	76	75	79	68
	b. Only for special cases	12	13	19	12	14	18	12	15
	c. Only for critical cases	4	6	3	–	5	–	8	12
	d. No provisions are made	2	1	3	–	1	3	–	5
	e. Other (Specify)	2	3	4	3	3	4	–	5
2.	Who discusses the result of the physical and medical examination with the child? (When there is need.) Check (V) one.								
	a. No provisions made	2	2	3	–	4	4	4	–
	b. School medical advisor	31	28	27	41	33	33	17	8
	c. Nurse	81	75	72	88	81	75	54	65
	d. Teacher	15	15	16	6	15	12	12	30
	e. Health teacher	6	2	2	3	3	1	8	2
	f. Guidance counselor	6	7	5	3	5	5	–	15
	g. Health co-ordinator	4	1	3	–	–	3	–	10
	h. Physical education instructor	4	5	4	3	6	5	4	2
	i. Principal	12	9	8	6	9	7	4	20
	j. Family physician	31	30	30	28	31	28	25	38
	k. Other (Specify)	12	8	10	16	5	8	8	18
3.	Is provision made for checking whether children visit a dentist at least once annually for examination and care? Check (V) one.								
	a. Yes, regularly	62	55	61	59	63	63	46	52
	b. No provisions	29	35	30	28	31	29	42	38
	c. Other (Specify)	6	10	8	9	8	8	8	8
4.	Who is responsible for having the physician's recommendations carried out? Check (V) one or more.								
	a. Nurse	75	75	64	78	77	71	58	58
	b. Teacher	35	27	20	34	24	20	29	32

TABLE 11.—*Continued*

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
	c. Health co-ordinator	6	1	2	3	1	1	4	5
	d. Physical education instructor	10	4	2	9	5	3	4	2
	e. Health teacher	10	1	2	6	1	3	4	5
	f. Guidance counselor	19	7	3	16	8	4	12	8
	g. Principal	35	21	12	25	21	11	25	30
	h. Parent	65	68	69	69	65	67	71	68
	i. Other (Specify)	–	6	5	–	5	5	–	8
5.	To what extent are parent conferences held? Check (V) one.								
	a. for every child	17	8	11	12	4	8	8	30
	b. for special remedial cases	67	73	65	72	76	67	54	60
	c. for critical cases	33	29	30	25	31	32	25	35
	d. Other	15	26	16	19	26	20	25	8

Section A
Remedial Services by Type of Service and Population Group

Item No.	Items and Options Under Each	Percentage of Responses by Type of Service and Population Group															
		Dental			Medical			Vision			Speech			Hearing			
		I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	
6.	The extent the community provides aid, etc.																
	a. Civic organizations	23	22	32	23	19	30	52	43	50	29	13	18	31	25	31	
	b. Public Tax Funds	40	28	19	46	25	18	29	18	9	40	22	13	38	20	11	
	c. Donations	2	13	12	2	17	13	8	14	13	2	11	6	6	12	7	
	d. The P.T.A.	19	19	20	10	16	15	23	21	14	10	9	8	10	11	10	
	e. Local Dept. of Public Health	42	24	17	44	25	20	23	6	13	15	5	9	23	6	12	
	f. Social Welfare Dept.	23	35	20	23	39	37	29	24	19	17	15	9	23	19	12	
	g. State Dept. of Maternal and Child Health	6	2	3	10	4	12	6	3	4	10	1	5	10	6	6	
	h. Private clinics	15	8	6	10	10	9	8	5	2	15	6	5	8	5	6	
	i. Semi-private clinics	10	6	2	8	5	1	8	4	2	8	7	2	4	7	2	
	j. Service clubs—Rotary, Kiwanis, etc.	23	29	42	15	34	45	58	66	78	17	15	24	36	36	45	
	k. Community Chest	25	5	9	23	10	13	21	6	8	10	4	6	12	5	7	
	l. Outpatient departments in hospitals	42	21	11	60	38	23	42	21	12	19	18	7	29	23	17	
	m. Others	27	14	10	4	11	13	17	17	8	12	17	16	15	13	11	

TABLE 11.—*Concluded*

SECTION B

Remedial Services by Type of Service and Population Group

Board of Education

Item No.	Items and Options Under Each	Percentage of Responses by Type of Service and Population Group														
		Dental			Medical			Vision			Speech			Hearing		
		I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
6.	The extent the community provides aid, etc.															
	a. Civic organizations	19	23	30	19	18	32	44	41	47	28	12	17	31	24	28
	b. Public Tax Funds	44	27	18	47	24	17	31	14	9	34	18	12	38	21	12
	c. Donations	3	12	12	3	18	13	9	13	13	–	10	7	6	12	8
	d. The P.T.A.	22	17	17	9	15	14	25	19	13	9	8	8	9	10	9
	e. Local Dept. of Public Health	34	21	8	41	27	17	19	6	7	9	5	5	16	6	8
	f. Social Welfare Dept.	19	36	20	16	41	34	22	22	22	6	14	12	16	18	14
	g. State Dept. of Maternal and Child Health	6	3	4	12	5	13	6	4	5	6	1	7	9	6	8
	h. Private clinics	19	10	4	16	10	8	12	6	1	16	5	7	12	6	8
	i. Semi-private clinics	12	8	3	9	6	1	12	5	3	12	8	3	6	8	3
	j. Service clubs—Rotary, Kiwanis, etc.	25	28	43	16	36	46	50	63	78	12	12	26	31	35	42
	k. Community Chest	25	9	9	19	12	13	22	6	9	16	4	7	19	5	8
	l. Outpatient departments in hospitals	47	21	13	66	40	25	47	22	13	25	18	8	44	22	17
	m. Others	34	15	12	3	12	14	22	19	8	19	13	18	16	13	12

SECTION C

Remedial Services by Type of Service

for Board of Health and for Joint Administration

Item No.	Items and Options Under Each	Percentage of Responses by Type of Service and Administrative Organization									
		Bd. of H. Dental	Joint Dental	Bd. of H. Medical	Joint Medical	Bd. of H. Vision	Joint Vision	Bd. of H. Speech	Joint Speech	Bd. of H. Hearing	Joint Hearing
6.	The extent the community provides aid, etc.										
	a. Civic organizations	21	32	25	25	67	52	25	20	33	35
	b. Public Tax Funds	33	25	25	32	21	20	29	32	12	22
	c. Donations	4	15	4	12	4	18	8	8	8	8
	d. The P.T.A.	29	20	12	18	29	15	12	10	17	10
	e. Local Dept. of Public Health	38	48	25	45	12	28	8	20	17	22
	f. Social Welfare Dept.	25	30	38	40	25	25	12	18	17	20
	g. State Dept. of Maternal and Child Health	–	2	8	5	–	2	4	5	4	5
	h. Private clinics	4	8	12	5	–	2	12	2	–	–
	i. Semi-private clinics	–	2	–	2	–	–	4	–	4	–
	j. Service clubs—Rotary, Kiwanis, etc.	25	35	21	35	67	82	17	22	42	48
	k. Community Chest	12	10	12	15	8	8	4	2	4	2
	l. Outpatient departments in hospitals	12	20	29	32	17	18	8	10	12	22
	m. Others	4	10	8	8	8	8	12	15	12	10

The nurse is the member of the health service program who informs the parent concerning the outcome of the examination in all three population groups, as shown by Table 10. The only other options to receive any appreciable recognition by all three groups were the principal and the teacher. The nurse and the school medical adviser recommend the pupil for referral for further diagnosis or treatment when serious deficiency or health problems are discovered.

The principal excludes the pupils from school when they manifest symptoms of a communicable disease in population groups I and II, but the school nurse attends to this service in most of the cities in population group III.

For all groups, the most widely practiced re-admission policy for those students who have been excluded on suspicion of communicable diseases is the medical certificate from the family physician. In many of the cities a member of the department of public health also issues this certificate.

There is no unanimous agreement by any one of the three population groups on the agency to which a mentally or emotionally disturbed child can be referred.

Analysis of the item concerned with the provisions made for follow-up services, shown in Table 11, reveals that all three population groups place emphasis on providing this service regularly for every student when the need is indicated. A very small group of cities has this follow-up service only for special cases.

The nurse is the professional person who discusses the results of the physical and medical examination with the child when there is a need.

Provisions are made by the majority of the cities for checking whether children visit a dentist at least once annually for examination and care.

Four options signifying those responsible for having the physician's recommendations carried out received substantial recognition. The nurse attends to this work in the vast majority of cities; in addition, the parents share part of this responsibility.

In Table 11, it is shown that parent conferences are held for special remedial cases in 67 percent of the cities in population group I, 73 percent of the cases in group II, and 65 percent of the localities in group III.

A comparison of the options under Item 6 on Table 11 indicates that a substantial number of cities in all three population groups have methods of providing aid for those children who are unable to pay for dental, medical, visual, speech, or hearing services.

Most of the participating cities provide measures for special education for the children. Results of the investigation covering this item are in Table 12.

The American Red Cross First Aid and Safety Service Practices are administered by a variety of personnel in all of the participating cities, as shown in Table 13.

TABLE 12.—PROVISIONS FOR SPECIAL HEALTH SERVICES

Item No.	Items and Options Under Each	Percentage of Responses by Administrative Organization							
		Census Population Group Only			Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
1.	Indicate by checking (√) one or more if your school system provides special education for the following:								
a.	Children handicapped by physical defect, disorder or disease	96	86	77	100	87	78	71	88
b.	Children with superior intellectual capacity	46	29	17	47	29	17	29	28
c.	Children who are emotionally disturbed or socially maladjusted	60	41	36	59	44	34	25	55
d.	Children who are mentally retarded	98	90	77	100	88	75	92	92
e.	Gifted children	42	21	10	44	21	8	12	30
f.	Exceptional child	56	31	20	66	29	16	33	38
g.	Other (Specify) Sight saving class	17	12	14	19	12	12	12	18
	Speech and hard of hearing clinic, Crippled children's class.								

TABLE 13.—RED CROSS PROGRAMS

Item No.	Items and Options Under Each	Percentage of Responses by Administrative Organization							
		Census Population Group Only			Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
1.	Indicate school personnel who administers American Red Cross First Aid and Safety Service practices. Check (√) one or more.								
a.	Teacher	75	60	69	69	55	67	75	80
b.	Nurse	83	75	74	91	86	76	42	68
c.	Principal	62	53	52	59	54	54	50	55
d.	Health teacher	40	26	34	44	27	36	17	35
e.	Physical education instructor	71	68	68	69	72	68	58	68
f.	Coach	67	44	53	62	44	55	46	58
g.	Clerk	25	21	12	28	24	12	17	10
h.	Students	9	7	7	9	8	5	8	8
i	All personnel	12	4	11	16	4	11	4	10
j	Others (Specify)	12	13	8	9	13	9	12	10

Table 14 shows that there is agreement in all of the population groups that the functions of the guidance department and the functions of the school health service administrators should be co-ordinated only as the need arises. In group I, 31 percent of the cities indicate that these two departments are closely co-ordinated by regular conferences.

TABLE 14.—CO-ORDINATION OF GUIDANCE AND HEALTH SERVICES

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
1.	To what extent are the functions of the Guidance Department and the functions of the School Health Service Administrator co-ordinated? Check (V) one.								
	a. Regularly through scheduled conferences	31	20	28	28	19	16	17	25
	b. Only as the need arises	71	72	66	72	76	68	67	58
	c. Others (Specify) ———	6	11	6	6	8	4	17	12

All of the cities indicate that the majority of the school systems have opportunities for in-service education for the health service personnel, and for informing the teachers about the school health service program. The method of implementation varies in the three population groups, as indicated in Table 15.

Planned conferences between the individual teachers and nurses are scheduled only as the situation demands it in the great majority of cities in all three population groups.

The majority of the cities in groups I and II have representatives from the local medical and dental societies and voluntary agencies on the school health council or advisory board; whereas in group II, only 43 percent of the cities have this organization.

There are additional items which the reader may wish to investigate on Table 15 concerning miscellaneous school health services. Eighty-three percent of the cities in population group I have provisions for the school health authorities to confer with leaders of the local medical and dental professions and leaders of other community agencies; 67 percent of the localities in group II and 72 percent of the cities in group III have made these provisions in their school health service program.

The three population groups vary as far as the problems are concerned within their respective school health service programs. All of the options

TABLE 15.—OTHER IMPORTANT SCHOOL HEALTH SERVICES INCLUDED IN THE PROGRAM

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
1. a.	Are there opportunities for in-service education for health service personnel and to inform the teachers about the school health service program?								
	(1) Yes	92	81	70	97	82	74	71	78
	(2) No	8	15	22	3	14	21	21	18
b.	How is this implemented? Check (V) one or more.								
	(1) By conferences or workshops assisted by:								
	(a) ear specialist	42	21	10	50	22	9	4	25
	(b) eye specialist	44	22	10	50	22	11	12	22
	(c) sch. med. advisor	50	36	21	66	41	26	25	10
	(d) pub. health physician	27	23	21	25	19	16	21	42
	(e) nurse	83	61	58	94	64	64	50	60
	(f) health teacher	25	10	11	28	15	11	4	20
	(g) dental hygienist	19	28	13	25	28	16	12	15
	(h) dentist	52	19	16	56	22	18	12	20
	(i) private physician	33	16	14	34	15	14	12	22
	(j) psychiatrist	35	24	12	44	24	12	4	25
	(k) orthopedist	25	10	7	28	12	7	—	15
	(l) psychologist	54	40	23	62	41	25	12	40
	(m) social worker	31	17	17	34	18	13	12	28
	(n) specialists from volunteer health organizations	29	25	16	28	21	16	25	30
	(o) other (Specify)	19	14	11	19	14	11	17	12
	Monthly in-service meetings with the nurses								
	Teachers participating in various study groups								

TABLE 15.—*Continued*

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
2.	Planned conferences between individual teachers and nurses are scheduled: Check (V) one.								
	a. Weekly	6	6	2	6	3	1	12	8
	b. Monthly	—	4	4	—	3	4	—	8
	c. For every child	12	11	5	16	10	3	8	12
	d. Only as a situation demands it	71	73	79	62	76	82	79	68
	e. At the time of the classroom visitation	29	24	21	25	28	21	21	18
	f. Other (Specify)	17	6	12	19	6	11	—	18
	Annual conferences with each teacher at elementary level.								
	Scheduled conferences at elementary level.								
3.	Do you have representatives from the local medical, dental societies, and voluntary agencies on your school health council or advisory board? Check (V) one.								
	a. Yes	65	53	43	56	55	38	42	70
	b. No.	34	37	46	41	37	50	42	25
4.	Are provisions made for the school health authorities to confer with leaders of the local medical and dental professions and leaders of other community agencies?								
	a. Specify briefly how accomplished:	83	67	72	84	67	72	75	70
	School health council or advisory board conferring with local medical and dental societies and leaders of other community agencies.								
	Co-ordinated conferences arranged by								

TABLE 15.—*Continued*

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
	school medical advisor between leaders of local medical and dental societies and other agencies. School health personnel on committees with local medical society which meets monthly. Special conferences or seminars with local medical advisory committee. National health week; assembly programs on health.								
5.	Indicate by a check (V) which of the following items you consider problems. Double check the one single problem most serious.								
	a. Lack of a coordinator	8	17	19	—	15	14	29	25
	b. Lack of cumulative records	6	3	4	3	4	—	4	12
	c. No follow-up program	8	4	15	6	4	16	12	8
	d. No contact with parent	6	5	—	9	5	4	4	2
	e. No nurse, teacher conference	6	4	4	3	4	5	8	2
	f. Lack of time per pupil for examination	29	26	4	34	28	28	38	15
	g. Lack of personnel adequately trained	25	20	28	19	21	25	29	25
	h. No full-time school personnel	8	5	26	—	4	8	21	15
	i. Lack of co-operation between departments of education and departments of public health	4	3	11	3	4	4	—	2
	j. The need for a coordinator from the dept. of education	2	6	3	—	5	1	12	2
	k. The need for a coordinator from the dept. of public health	4	4	2	3	5	5	4	2
	l. The need for a joint								

TABLE 15.—*Continued*

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
	co-ordinator from both the dept. of public health and education	6	9	5	3	5	8	21	15
	m. Lack of funds	44	31	10	31	27	25	50	48
	n. Lack of administrative support	6	2	29	9	3	—	—	—
	o. Lack of proper relationship between local medical and dental societies	8	8	7	9	9	7	4	8
	p. Others (Specify) More full-time personnel. More full-time school medical advisors, nurses, dentists and dental clinics. Dir. of school health services. More time needed to manage follow-up program. More clerical assistance. Better relationship between health service personnel and other school personnel. More thorough written policies. Carelessness on parents part in failing to attend to remedial work.	19	39	24	28	41	28	21	15
6.	Indicate which agencies render assistance to the school health services program in your community. Check (V) one or more.								
	a. State Div. of Maternal and Child Health	52	34	40	47	31	39	50	48
	b. State Dept. of Public Welfare	46	38	46	47	37	41	46	52
	c. State Dental Health Services	42	43	47	41	42	45	38	55
	d. State Nutrition Services	35	36	36	34	35	29	54	42
	e. State Tuberculosis Services	56	58	67	56	54	70	62	62
	f. State Society for the Deaf	40	36	36	38	36	36	29	45

TABLE 15.—*Concluded*

Item No.	Items and Options Under Each	Percentage of Responses by							
		Census Population Group Only			Administrative Organization				
					Board of Ed. by Census Group			Bd. of Health	Jointly
		I	II	III	I	II	III		
g.	State Society for the Blind	48	38	39	44	37	38	33	52
h.	State Social Service Bureau	23	12	17	28	10	14	4	28
i.	State Dept. of Mental Health	46	44	49	38	46	47	42	55
j.	State Crippled Children Service	79	66	70	78	71	66	50	82
k.	American Red Cross Safety Services	60	57	51	59	54	53	54	60
l.	Visiting Nurses Organization	42	23	21	38	24	22	25	25
m.	Local Welfare Dept.	65	60	57	56	63	54	58	68
n.	Locally endowed clinics	52	35	17	44	35	18	38	35
o.	Voluntary professional assistance	40	39	49	34	41	45	38	55
p.	Traveling clinics	17	18	13	16	17	12	12	22
q.	Local civic organization	56	56	63	59	55	58	46	75
r.	P.T.A. organization	85	61	73	88	83	68	75	85
s.	Service Clubs	71	80	76	66	83	74	58	90
t.	Churches	15	21	32	12	21	29	8	40
u.	Women's Auxiliary	33	22	14	34	21	13	17	28
v.	Junior League	44	22	12	44	19	7	21	40
w.	National Foundation for Infantile Paralysis	77	70	71	72	71	68	79	75
x.	Local Medical Society	83	69	54	78	72	50	54	80
y.	Local Dental Society	77	66	52	75	69	49	42	78
z.	State Dept. of Ed.	60	65	75	59	67	72	62	72
	Others (Specify) Local Tuberculosis Organization. State Department, Public Health. Local child guidance clinic. Hospital clinics. State university instructional services. City, County Health Departments.	12	15	14	16	17	16	4	10

listed on the inquiry form indicating the agencies rendering assistance to the school health service program received important percentages, showing that they all assist in varying degrees in all of the participating cities from the three different population groups.

Assumptions Made

The planning of this study was based upon the following suppositions: (a) that there is a need for knowing what school health service practices actually are in existence; (b) that the study might prove valuable in helping to better serve the child in cities where practices are not optimum; (c) that the study of current practices might prove helpful to administrators of school health service in elementary and secondary schools; and (d) that administrators might be interested in knowing what differences there are in school health service programs administered by education departments, public health departments, or jointly.

Conclusions

The first objective of this study was to analyze and compare the school health service practices in three separate census groupings, using random sampling techniques where necessary. Returns showed that all of the items and options listed on the inquiry form are in use in the school health service program of one or more of the selected cities.

The percentage analysis revealed common weaknesses within the program, such as:

1. Lack of co-ordination between school health services, physical education, and health instruction
2. Lack of full-time and part-time personnel to carry out this health service program
3. Lack of specific personnel to plan and construct the school health record card in respect to content and format, in all groups
4. Lack of parent conferences for the child
5. Insufficient community aid for those children who cannot afford to pay for remedial medical, dental, speech, and hearing services
6. Insufficient number of planned conferences between individual teachers and nurses for every child
7. Lack of adequately trained personnel, which limits the follow-up program
8. Weakness in respect to the representation of the local medical and dental societies and voluntary agencies on the school health council or advisory board
9. Inadequate provision for special education of all types.

The second objective of this study was to show by separate analysis of the options for the respective census groupings what differences there are, if any, in school health practices in communities of varying sizes. Of the three population groups represented, large metropolitan communities, according to the percentages secured in this study, offer more services than either of the other two groups. Findings of the study indicate that:

1. More large communities have administrative heads to co-ordinate health services, physical education, and health instruction program.

2. There are not only more full-time professional personnel available but also more kinds of professional personnel to meet the needs of the child in the large metropolitan areas.

3. The school medical adviser and the nurse attend to having the child referred for further diagnosis or treatment more often in cities than in smaller population groups.

4. Parent conferences for every child are held in cities in group I to a greater extent than in the other groups.

The percentages do not prove that population groups II and III have programs superior to the other.

The final objective of this study was to show what different practices are related to different plans of administration of the school health services. A comparison of three plans for administering the school health services is unfair because of the number of cities found in each group (see Table 1). The analysis does reveal, however, that programs under the control of the board of education include more of the options found on the inquiry form than do those under the two other administrative plans. Thus communities where school health services are under the control of the board of education have a more complete program to meet the needs of the child. There is dependable evidence that those programs under the control of the joint administrative plan include more services for the child than those under the jurisdiction of the board of health.

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(Submitted 6/11/58)

Venous Blood Pressure Measurements During Exercise by the Strain Gauge and Pressure Amplifier Method[1]

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Abstract

Venous blood pressure measurements were made by direct cannulation of the median antecubital vein. Measurements were taken at rest, during a 5-minute exercise on the bicycle ergometer, and during a 15-minute recovery period. The range of resting pressure was from 73 to 169 mm. water, with a mean pressure of 120 mm. water. The pressure during exercise increased in every case and was maintained throughout the exercise. The average increase was 118 mm. water, representing an increase of 95 percent. Venous pressure during recovery showed a very rapid drop during the first three minutes and then exhibited a progressively slower decline until a constant level was reached.

TWO METHODS, the direct and the indirect, have been employed to estimate the venous pressure in man. The indirect method consists in determining the external pressure necessary to produce collapse of a small superficial vein, or the pressure which just prevents refilling of a vein which was previously emptied by a "milking" process toward the heart . The direct method consists in inserting a needle directly into the vein and placing a manometer in communication with the vein by means of a tube which is attached to the needle.

The direct method of venous pressure determinations has been used infrequently, despite the fact that among researchers it is thought to be the simplest and most accurate method. Wood and McKee (6) believe that the reason for the scarcity of direct method studies is the lack of a suitable mechanical recording device. An argument against the direct method, as used in the past, is that continuous readings could not be made and readings could not be taken over an extended period of time. The method was also somewhat inconvenient because the instrument was set up in a more or less permanent position and all recordings had to be made within a few feet of the subject.

No study was found which evaluated the trends of venous pressure, during rest and exercise, using the direct method of recording. The few studies undertaken utilized the indirect method of determining venous pressure, and

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these present conflicting results. Hooker (1), the first of two individuals who have done the most thorough studies on venous pressure during exercise, carried out an experiment on five subjects using the indirect method for measurements of venous pressure. The form of exercise administered was stationary bicycle work, but no record was kept with regard to the amount of work done. The period of exercise ranged from 10 to 15 minutes. All venous pressure readings were made on the arm and were taken with the modified v. Recklinghausen instrument. Venous pressure increased with exercise in every case, with the average being 6 to 14 cm. water. This increase in venous pressure lasted throughout the exercise period and did not return to the base level immediately after exercise.

White (5) has also done some thorough studies on venous pressure during exercise. He experimented with an instrument similar to that of Hooker, the only difference being that in the White method pressure was applied instantaneously. His results were, to some extent, contradictory to those presented by Hooker. White found that during light muscular exercise, on a stationary bicycle ergometer, venous pressure increased, the rise being 40-50 mm. water, but fell immediately to or below base level upon cessation of work. He also experimented with heavy work loads and was able to show that the pressure increase was more pronounced in the early stage of the exercise but returned to or below the control level before the cessation of exercise. He further noted that upon work stoppage, venous pressure decreased still more, returning to base level in approximately eight to ten minutes.

Since the conclusions of Hooker and White were not in agreement, Schneider and Collins (4), using the indirect method, attempted to determine more fully the changes that occur in venous pressure during and after a period of exercise. They found that venous pressure increased with exercise, and in no case was there an appreciable decrease during exercise. They found also that venous pressure did not return to the base level immediately upon cessation of exercise, and there was no evidence of a drop below the control level occurring during recovery.

It is generally agreed that exercise is accompanied by an elevation of venous pressure. On the other hand, many overlook the significance of the degree of elevation of venous pressure during such exercise and of the length of time it requires to return to base level. The important factors in evaluating the functional significance of venous pressure are the degree of increase during exercise and the time necessary for it to return to its base level. Other important aspects to be considered are the differences in resting pressures, pressure increase during exercise, and the time required for it to reach its base level, in individuals with different degrees of cardiovascular fitness.

Specifically, this study seeks to determine, by the strain gauge and pressure amplifier method, the resting level of venous pressure and the relative magnitude of the changes that occur during exercise and recovery.

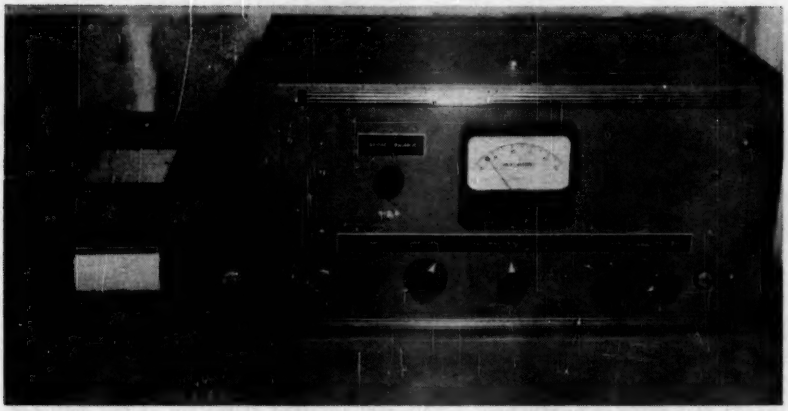


FIGURE I. The Pressure Amplifier. At right is the Pestel Pressure Amplifier; at left is the brush ink-writer; between lies the Statham Pressure transducer.

Pressure Amplifier

A brief summary regarding the specifications and uses of the pressure amplifier[2] has been reported by Pestel and Marbarger (2). The amplifier is of a carrier-frequency type, complete with a direct current output stage, capable of driving a rugged, high speed, direct writing oscillograph. The amplifier is provided with a five position step gain switch, together with a fine gain control, so that any pressure from a low value to a maximum gauge pressure can be made to produce full scale deflection. The amplifier is also provided with two switches: (a) zero position, so that any amplifier change may be detected and corrected without removing pressure from the strain gauge, and (b) calibration signal, in order that a constant degree of amplification can be observed and reproduced, thus allowing one to establish comparable records from day to day. Essentially, this is a means of converting pressure to electrical energy, from which a graphic record is made by the use of a brush ink-writer.

Procedure

Subjects: The present study covers the testing of 13 young men, volunteers from the physical education classes at the University of Illinois. The subjects were all normal healthy males and ranged in age from 18 to 26. The subjects were tested twice, approximately one to two weeks apart. Venous blood pressure recordings were taken at rest, during a 5-minute exer-

[2] All information concerning the circuit construction of the pressure amplifier was submitted by Mr. Clarence Pestel, of the Aeromedical and Physical Environment Laboratory, University of Illinois at Chicago.

cise period on the bicycle ergometer at a work load of 11,000 ft.lbs./min., and during a 15-minute recovery period.

Venous Blood Pressure Recordings: Recordings of venous blood pressure were made by direct cannulation of the median antecubital vein. A flexible plastic catheter was introduced into the vein and connected to the pressure transducer, containing salt solution, which in turn was balanced to zero by the pressure amplifier.

The subject was prepared for the venipuncture by the medical doctor. After the median antecubital area of the arm was painted with tincture of mercresin, it was anesthetized with procaine hypochlorite. The initial puncture of the vein was made with a 17-gauge needle, through which was placed the plastic catheter containing a stylet (which was inserted into the catheter in order to facilitate its insertion into the vein). After the needle and stylet had been removed, the catheter was connected to the pressure transducer by means of a syringe needle lock, which was inserted at the tip of the catheter. During the time the catheter was in the vein, it was flushed periodically with the anti-coagulative solution in order to ensure accurate pressure readings over an extended period of time.

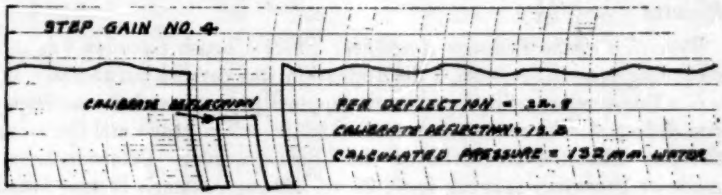
In the present study, the reference level used was the apex of the heart. This level was obtained, by a medical doctor, by methods of palpation and auscultation. The arm from which venous pressure readings were taken was immobilized by placing it on an armboard, hinged on the upper end in order to lend support to the upper arm. In obtaining venous pressure recordings during the exercise period on the bicycle ergometer, the armboard was clamped to a small platform, which was arranged on the side of the ergometer and could be clamped in position at any desired height. This was done in order that the venipuncture and zero point of the manometer could be maintained at heart level throughout the exercise.

Measurement of Venous Pressure Recordings: At every recording of venous pressure, where the pressure was calculated at a given time, the recording chart was marked for the step gain number and calibration signal. This was necessary because the calibration pen deflection is a function of, and proportional to, the gain of the amplifier. The calibration signal is used and operates to determine the desired pressure units from pen deflection in the following manner. When the selector switch is turned to calibrate, a very small portion of the 1,000-cycle oscillator voltage is fed into the input of the amplifier via the strain gauge and its associated resistance network. Through an initial calibration of the step gain, a factor was determined which gave a constant relationship between pen deflection due to a pressure applied to the pressure transducer and the deflection produced by the calibration signal. This factor was used to convert all pen deflections to pressure equivalents.

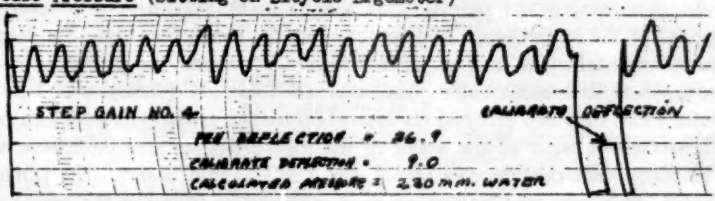
In measuring on the recording chart the pen deflection obtained during an unknown pressure reading, the deflection was averaged over a period of

15 seconds, 7½ seconds on either side of the minute reading. This procedure was followed in order to have a more representative reading in the event some unknown circumstance might have altered the deflection taken precisely on the minute. See Figure II for an illustration of this procedure.

Resting Pressure (Sitting in Chair)



Exercise Pressure (Sitting on Bicycle Ergometer)



Recovery Pressure (Sitting in Chair)

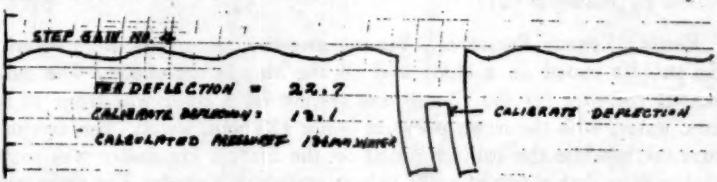


FIGURE II. Known pressure recordings at rest, during exercise, and recovery.

The following is an example of the procedure and computation of an unknown pressure. Step gain four was calibrated by the following steps: (a) fine gain control was adjusted to a calibration deflection of 30 mm., and this was called Dc; (b) a pressure applied to the strain gauge was carefully measured by a manometer to obtain a pen deflection of 35 mm. which was called Dp. The applied pressure was 20 mm. of mercury and was called Pc. Therefore:

Dc—30 mm.
Dp—35 mm.
Pc—20 mm.
P—Unknown pressure

When an unknown pressure was measured, a calibration deflection of 25 mm., designated Dc^1, and a pen deflection of 32 mm., noted as Dp′, was obtained.

The formula for calculating the unknown pressure is as follows:

$$P = Pc \times \frac{Dp' \times Dc}{Dp \times Dc'} = P = 21.94 \text{ mm. Hg} = 20 \text{ mm. Hg} \times \frac{32}{35} \times \frac{30}{25}$$

Results

Precision of the Pressure Amplifier: Since a brush recorder was used for recording venous pressure, a determination was carried out to show if there was a linear relationship between the applied pressure and the corresponding pen deflection. A pressure was applied to the strain gauge and the amount of the pen deflection measured on the brush recorder. Determinations were made at pressures ranging from 25 to 100 mm. water. It was found that there existed a linear relationship between the applied pressure and the corresponding pen deflection.

In determining the precision of the pressure amplifier, a pressure was applied to the strain gauge and recorded on the brush recorder. Six measurements were taken at each of eight different pressures, the pressures ranging from 45 to 101 mm. water. The average deviation (A.D.) was 1.25 mm. water. The standard error of an individual measurement was 1.54 mm. water. The standard error of the mean of the measurements was 0.69 mm. water. The 95 percent confidence interval was $X \pm 3.13$ mm. water. The range and variability of venous blood pressure in man can be found in the recent publication by Rochelle (3).

Resting Venous Pressures: Venous pressure recordings were taken while the subject rested on a chair and on the bicycle ergometer. The range of venous pressure for the 13 subjects resting on a chair was from 73 to 169 mm. water, with the mean pressure being 120 mm. water. The venous pressure taken while the subject rested on the bicycle ergometer was somewhat higher than that obtained while he was seated on a chair. The mean pressure of the subjects taken while sitting on the bicycle ergometer was 130 mm. water, with a range from 92 to 172 mm. water.

Venous Pressure during Exercise: In every case venous pressure increased during exercise. In Table I are listed the resting pressure and the amount of maximum increase in pressure during exercise for the entire group of 13 individuals. The average maximum pressure increase during exercise was 118 mm. water, representing an increase of 95 percent. The maximum percent increase in venous pressure for each individual during exercise is given in Table 2.

Venous Pressure during Recovery: Venous pressure recordings were taken at every minute during the 15-minute recovery period except the second minute, at which time the subject was transferred from the bicycle ergometer to a chair.

TABLE 1.—RESTING VENOUS PRESSURE ON CHAIR AND BICYCLE ERGOMETER AND THE MAXIMUM INCREASE IN PRESSURE DURING EXERCISE

	Resting Venous Pressure (mm. water)						Maximum Increase in Pressure During Exercise		
	On Chair			On Bicycle					
Subject	Test I	Test II	Average	Test I	Test II	Average	Test I	Test II	Average
R.B.	91	86	89	111	87	99	170	111	140
J.B.	131	128	130	146	131	138	89	204	146
J.S.B.	138	143	140	125	148	136	102	32	67
B.B.	128	134	131	126	135	130	146	72	109
H.C.	148	132	140	151	132	142	79	58	66
A.J.	138	134	136	162	160	161	103	131	117
H.K.	124	128	126	130	142	136	62	31	42
L.L.	74	72	73	92	93	92	157	211	184
V.L.	107	95	101	138	113	126	152	135	144
M.M.	114	118	116	112	115	114	144	207	175
G.T.	166	172	169	185	160	172	187	192	190
E.W.	125	153	139	126	154	140	61	46	54
P.Z.	71	86	78	104	91	98	88	73	81

TABLE 2.—MAXIMUM PERCENT INCREASE IN VENOUS PRESSURE DURING EXERCISE

Subject	Test I	Test II	Average (%)
R.B.	153%	127%	140%
J.B.	61	156	108
J.S.B.	81	22	52
B.B.	116	53	84
H.C.	52	44	48
A.J.	64	82	73
H.K.	48	15	32
L.L.	171	227	199
V.L.	110	118	114
M.M.	128	180	154
G.T.	101	120	110
E.W.	48	30	39
P.Z.	85	80	82

An analysis of all 13 graphs revealed that the greatest decrease in pressure occurred during the first three minutes of recovery. In four of the subjects, J.S.B., P.Z., L.L., and R.B., the pressure did not return to the basic resting level during the 15-minute recovery period. In three of these subjects, J.S.B., P.Z., and R.B., however, the venous pressure was within 16 mm. of the basic resting pressure. Subjects G.T. and J.B.'s pressures returned to the basic resting level within 13 and 12 minutes, respectively. Three subjects, H.C., M.M., and V.L., recovered within a period of 7 to 9 minutes. Of the remaining four subjects, H.K. recovered within 4 minutes, and B.B., A.J., and E.W.'s pressures returned to the basic level in 3 minutes.

In four of the subjects, venous pressure was found to drop below the normal resting pressure. Subject H.K., who had recovered within 4 minutes, showed a drop of pressure below the basic level at the sixth minute which continued through the fifteenth minute, at which time the pressure was 16 mm. water below the resting level. The other three subjects, B.B., A.J., and E.W., who had recovered within 3 minutes, showed an average drop of 45 mm. water below resting level. Two of these three subjects, A.J. and E.W., however, showed an increase in pressure during the latter part of the recovery period and at the fifteenth minute were only approximately 14 mm. water below the basic resting level.

The average resting venous pressure of the 13 subjects was 120 mm. water and the average maximum increase during exercise was 118 mm. water. The pressure during exercise increased in every case, but in no case was there any appreciable decrease in pressure after the initial increase. This is not in agreement with the conclusions of White and Moore, who found that venous pressure returned to the basic resting level during the latter half of an exercise period.

The findings in this study (that an increase in venous pressure occurred and was maintained throughout the exercise) do, however, coincide with the results of Hooker and of Schneider and Collins.

It was found that some of the subjects showed the greatest increase in pressure during the first or second minute and others ranged between the second and fourth minutes; two subjects showed only a slight increase. Six of the subjects showed the greatest increase in pressure at the first minute of exercise; two at the second minute; one at the third minute; and two at the fourth minute. The average time of the greatest increase in pressure for the entire group was 2.4 minutes. The average time that the maximum pressure occurred during exercise was 4.4 minutes.

Venous pressures during recovery from exercise were found to drop rather rapidly during the first three minutes and then exhibited a progressively slower decline for the remainder of the recovery time. In four of the subjects the venous pressure dropped below the basic resting level. This is not in agreement with the results of Hooker or those of Schneider and Collins, who found that the venous pressure did not drop below the basic resting level. The recovery results are in accordance with those of White, who found that pressures dropped below subnormal. The findings, however, do not corroborate those of White in respect to the actual time of recovery.

Summary of Results

The direct strain gauge and pressure amplifier method for recording pressures is very reliable, the standard error of the mean being .69 mm. water. By this method, venous pressure can be recorded with considerable freedom at some distance from the subject. Also, continuous records can be made and these recordings can be taken over a period of some two or three hours.

The average resting pressure for the 13 subjects was 120 mm. water, with a range of 73 to 169 mm. water. All pressure recordings were referred to the apex heart level.

Every subject exhibited an increase in pressure during exercise, with the average increase being 118 mm. water, representing an increase of 95 percent. In no case was there any appreciable decrease in pressure during the latter part of the exercise period after the initial increase had occurred. The average time of the greatest increase in pressure during exercise was 2.4 minutes. The average increase at the time of the greatest increase was 65 percent. The average maximum increase in pressure for the entire group occurred at 4.4 minutes.

Venous pressure during recovery showed a very rapid drop during the first three minutes and then exhibited a progressively slower decline until a constant level was reached. The pressure of four did not return to the basic resting level during the 15-minute recovery period. Four showed a drop below the resting level; these recovered within 3 to 4 minutes. The pressure did not, however, return to the resting level during the 15-minute recovery period. Three subjects recovered within a period of 7 to 9 minutes and two subjects, within 12 to 13 minutes.

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(Submitted 6/19/58)

Psychological Refractory Period in Simple Paired Responses

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Abstract

An experiment was performed for the purpose of obtaining further evidence on the psychological refractory period. Two groups of five subjects completed simple and paired reaction-time responses to the appearance of visual signals, and the procedures for groups varied only in respect to the duration of stimuli.

The major findings were: (a) the duration of signals had no significant effect upon either simple or paired reaction times; (b) delays in the second reaction time in paired responses persisted throughout the entire range of 50-500 millisec. between signals; (c) when the interval between signals was greater than the first reaction time in paired responses, the second reaction time was inversely related to the interval between signals; and (d) the first reaction time in paired responses was significantly longer than the simple reaction time for that member.

IN EXPERIMENTAL studies involving reaction-time (RT) responses to a series of discrete stimuli, it has been observed that manipulation of the interval between stimuli will frequently produce changes in the speed of response. For example, it has been found that when the interval between pairs of discrete stimuli is varied from very short to very long intervals, the RT to the second stimulus will be longer for short intervals than for fairly long intervals. In this sense, the second RT is said to be delayed. The occurrence of this delay has led to the hypothesis of a psychological refractory period. According to this hypothesis, the delay in reacting to the second of two consecutive stimuli is the result of a time-lag, or block, in the central mechanisms of the nervous system.

As postulated by Welford (11), a definite organizing time is required for the central mechanisms to deal with information presented by a stimulus and to organize the appropriate response. During this organizing time the central mechanisms are presumed to be refractory to a second stimulus. Should information from a second stimulus arrive during the organizing time to a previous stimulus, it must be "held in store until the central mechanisms are free" (11, p. 18).

It is further postulated that the interval during which the central mechanisms are refractory to a second stimulus may also be influenced by the possibility that:

The central mechanisms are liable to become engaged by stimuli fed back from the response, particularly from those parts of it where there is rapid acceleration or deceler-

ation of movement, or where some definite sound or tactual change is produced. The perception of any such feedback will require central organization time (11, p. 18).

Thus the refractory period to the second of two stimuli may include the organizing time for dealing with information from the first stimulus plus the time for perception of feedback from the first response.

Early consideration of the refractory period led to the conclusion that the response to a second stimulus would be delayed, or might even be omitted, whenever the interval between stimuli was 500 millisec. or less. It has been frequently suggested that 500 millisec. represents the probable minimum duration of the refractory period for responses of the upper extremities (1, 4, 5, 7, 9, 10). A refractory period of this duration is presumed to occur for consecutive responses of the same or different response members. It is also presumed to occur in a large variety of responses: simple key manipulation, movements of precise extent, tracking movements, etc.

A recent investigation by Davis (2), however, has indicated that the refractory period need not always be as long as commonly suggested. In this investigation, which appears to be the first of a series of investigations designed to assess the extent to which feedback stimuli occupy the central mechanisms, two subjects (*S*'s) were given the task of responding to pairs of visual stimuli. The stimuli were presented by means of a moving paper band, and the interval between pairs of stimuli was randomly varied over a range of 50-1000 millisec. The consecutive responses involved depression of two signal keys with different combinations of fingers: one *S* used the first finger of each hand; the other *S* used the first finger and the second/third fingers of the right hand. For purposes of comparison, each *S* also responded to the appearance of a single stimulus with each response member.

The results for each *S* indicated that the RT's for the first response member in paired responses were normal, that is, they were similar to the RT's to a single stimulus. The RT's for the second response member in paired responses, however, were found to be significantly longer than the first RT whenever the interval between stimuli was less than the first RT, which was approximately 230 millisec. for each *S*. Furthermore, these delays were inversely related to the interval between stimuli. For intervals between stimuli which were less than the first RT, the second RT was delayed by the amount

First RT—Interval between stimuli.

If the RT for the second response member to the same stimulus in isolation be designated as the "normal" RT, the RT for this member in paired responses was found to take the value

Normal RT+First RT—Interval between stimuli.

When the interval between stimuli was greater than the first RT, there was no delay in the second RT. In fact, the second RT tended to be shorter than the first RT when the intervals between stimuli ranged over the values of 400-800 millisec. According to Davis, this decrease in the second RT could be attributed to an "expectancy" effect of the type described by Mowrer (6).

In accounting for the fact that the refractory period for his two *S*'s did not exceed one RT, falling considerably short of previous estimates, Davis concluded that the duration of a refractory period was undoubtedly dependent upon the control required for a particular response. In regard to the simple response used in his investigation, he states:

> For key pressing the amount of force applied to the key is relatively unimportant. As long as it exceeds a critical value the key will open. The "inevitable kinaesthetic stimulation" as a result of the movement may be present, but its value is unimportant for controlling the movement (2, p. 37).

In view of the importance of Davis' results for assessing the effects of a refractory period upon human performance—especially in complex skills requiring successive changes in performance to a rapidly changing stimulus situation—it was deemed worthwhile to undertake another investigation on the problem. The major purpose of the present study was to confirm Davis' findings that (a) the refractory period for a response requiring little in the way of precise control does not exceed one RT, and (b) the amount of delay is inversely related to the interval between stimuli.

For purposes of broadening the base upon which generalizations might be made, the following modifications in procedures were introduced: (a) the responses involved movement of the hand off signal keys, (b) the paired response stimuli were presented by means of light signals, (c) the light stimuli were presented under two light-duration conditions, and (d) the intervals between pairs of stimuli were restricted to a range of 50-500 millisec.

Method

RT measures were obtained for each hand alone and for paired responses of the left and right hand. In completing these responses, *S* sat at a table in a darkened room and reacted to the appearance of one or two light stimuli by raising the appropriate hand off its signal key. The stimuli were presented under two duration conditions. In one condition, the stimuli were presented for a duration of 30 millisec.; this condition provided for a situation in which there was never any overlap of paired stimuli, as appears to have been the common practice in investigations on the psychological refractory period. In the other condition, the stimulus duration was controlled by *S*'s key, that is, a light remained on until *S* released the appropriate key, as is a frequent practice in RT experiments. In this latter condition, of course, the paired stimuli overlapped whenever the interval between stimuli was less than the RT of the first hand.

APPARATUS

The signal keys were secured to the table top so that they were 8 in. apart and 15 in. beyond the edge of the table at which *S* sat. Two neon lamps served to provide the response stimuli. These lamps were embedded in a black vertical panel which was attached to the far end of the table. The lamps were located so that they were 2¼ in. apart, 14½ in. above the table

top, and 44 in. from *S*'s end of the table. A 2 in. x ¼ in. vertical slit extended through the panel midway between the stimulus lamps. This slit was illuminated from behind by a pilot lamp, and it served as a fixation point for *S* during test trials. The illuminated slit also enabled *S* to distinguish between the "left" light, which required a response of the left hand, and the "right" light, which required a response of the right hand.

A bank of electronic interval timers and the associated equipment made it possible to: (a) present the light stimuli under the two duration conditions described above, (b) sound a buzzer, which served as a preparatory signal, for a duration of 100 millisec., (c) vary the foreperiod between the end of the preparatory signal and presentation of a light stimulus, and (d) vary the interval between stimuli in RT responses involving paired reactions of the left and right hands.

RT's were recorded by means of two Standard Electric clocks. One clock recorded the interval between appearance of the left light and movement of *S*'s left hand off its signal key, and the other clock recorded the corresponding interval between the right light and movement of *S*'s right hand.

SUBJECTS AND PROCEDURES

Ten male students of Indiana University served as *S*'s. Their ages ranged from 25 to 39 years, the median being 29 years. The *S*'s were randomly assigned to two equal groups, and each group was assigned to one light-duration condition.

In an effort to obtain RT measures representing well-practiced performance, each *S* was required to complete 11 laboratory sessions. Although the sessions were arranged for consecutive days, only six *S*'s were able to maintain this schedule; the remaining four *S*'s completed their sessions over an interval of from 12 to 14 days. All *S*'s were tested individually, at the same hour each day, under the following schedule and conditions:

(a) On laboratory sessions 1-2-3-4-11, *S* completed 50 simple RT responses with each hand upon the appearance of a single light signal. Responses of the left hand were made to the left light, and responses of the right hand were made to the right light. Each light signal was preceded by the sounding of a buzzer, and the interval between the end of this preparatory signal and the appearance of a light was randomly varied over intervals of one, two, three, and four sec. *S* completed all responses for a single hand in blocks including 25 regular and 5 catch trials. Each block of trials was followed by a rest interval of approximately two minutes, and the order in which responses were completed was randomly varied over laboratory sessions.

(b) On laboratory sessions 5-6-7-8-9-10, *S* completed 100 RT responses of the left and right hand to the sequential appearance of the two light signals. In these trials, the left signal light always appeared first, and this was known by *S*. A buzzer was sounded before the appearance of each pair of light signals under identical conditions for the simple RT responses. The interval between pairs of signals was varied, in steps of 50 millisec., over a range of 50 to 500 millisec. These intervals were presented in a random order with the restriction that each interval be represented an equal number of times in a series of 100 trials. *S* completed paired responses in blocks, including 25 regular and 5 catch trials. During catch trials, only the left signal light appeared. A rest of approximately two minutes was given after each block of trials.

Analysis of Data

The measures analyzed were the mean RT's obtained for each *S* during each laboratory period. A separate analysis of variance was carried out for each hand for both simple and paired responses. With repeated measurements on the same *S*'s, and with *S*'s divided into subgroups for different stimulus conditions (light signal durations), the analysis took the general form described by Edwards (3, p. 288-97). When justified by the *F*-ratios from the analysis of variance, the differences among means were evaluated according to the procedure suggested by Tukey (8). This procedure, which divided means into groups that are homogeneous among themselves but different from each other, includes Studentized tests for excessive gaps, stragglers, and excessive variability. Simple *t*-tests were used for comparing RT means for different hands and different responses.

Prior to collection of the data, it was decided to require a significance level of 5 percent for rejection of a null hypothesis, and all conclusions were based upon this probability level. For the convenience of those who might wish to evaluate results at a higher probability level, the values of *F* and *t* for significance at the 1 percent level are reported in the several summary tables.

Results

SIMPLE RT RESPONSES

The mean RT's for simple responses of the left and right hand during five test days and under two stimulus conditions are presented in Table 1. The results for the first four consecutive test days reveal little in the way of progressive improvement, and a comparison of results for these days with day 11 indicates that the intervention of performance involving paired responses of both hands appeared to have no marked influence upon simple responses of either hand. As might be expected, the variances attributable to "between days" were not found to be significant (Table 2).

TABLE 1.—MEAN REACTION TIMES FOR LEFT AND RIGHT HAND FOR FIVE TEST DAYS AND TWO STIMULUS CONDITIONS

Stimulus Conditions	Test Days				
	1	2	3	4	11
Reaction Time of Left Hand in Millisec.					
Stimulus 1[a]	192	202	190	199	187
Stimulus 2[b]	214	198	209	200	200
Reaction Time of Right Hand in Millisec.					
Stimulus 1[a]	191	189	187	200	190
Stimulus 2[b]	209	205	214	198	200

[a] Response stimuli terminated by *S*'s key.
[b] Response stimuli presented for 30 millisec.

TABLE 2.—F-RATIOS FOR SINGLE REACTION TIME MEASURES

Source	df	Left Hand	Right Hand	Confidence Levels 5%/1%
Between Stimulus Conditions (S)	1/8	2.10	3.55	5.32/11.26
Between Days (D)	4/32	0.88	0.46	2.67/3.96
Interactions: DxS	4/32	2.08	0.77	2.67/3.96

An examination of results for the two stimulus conditions (Table 1) shows that RT's to a light stimulus presented for 30 millisec. were somewhat longer than RT's to a stimulus terminated by *S*'s key in 8 out of 10 comparisons. As shown in Table 2, however, the *F*-ratios for "between stimulus conditions" were not significant.

Since the differences in RT measures for test days and stimulus conditions could reasonably be attributed to sampling variations, the several measures were combined to obtain a single "best" estimate of the mean RT for each hand. For the 10 *S*'s used in this investigation, RT's of 199 and 198 millisec. were found for the left and right hand respectively. The difference between these means was not significant (t=0.38), and these pooled measures were used for comparisons of simple and paired responses.

PAIRED RT RESPONSES

Practice Effects. Evaluation of practice effects upon paired responses was limited to performance of the left hand. Although this choice was partly arbitrary, it was also based upon the fact that the experimental procedures were such as to provide reasonably reliable measures of the daily performance of this member. Each *S* completed 100 responses daily with the left hand, and these responses, presumably, were uninfluenced by other experimental variables. Responses of the right hand, however, involved 10 different intervals between light stimuli, and it was possible to obtain only 10 RT measures for each interval during each day's schedule of 100 paired responses.

The mean RT's for the left hand in paired responses during six test days and under two stimulus conditions are summarized in Table 3. The results suggest that (a) there was a general trend for RT's to decrease over successive test days, with the most marked changes occurring during the first few days, and (b) there was no consistent difference in RT measures for the two stimulus conditions. The *F*-ratios for these effects are presented in Table 4. Only the variance attributable to "between days" was found to be significant.

Using the conservative procedures recommended by Tukey (8) for evaluating the differences among means for test days when stimulus conditions were

TABLE 3.—MEAN REACTION TIMES FOR LEFT HAND IN PAIRED RESPONSES FOR SIX DAYS AND TWO STIMULUS CONDITIONS

Stimulus Conditions	Test Days					
	5	6	7	8	9	10
Stimulus 1[a]	280	258	227	222	223	219
Stimulus 2[b]	276	249	233	224	222	223

[a] Response stimuli terminated by *S*'s key.
[b] Response stimuli presented for 30 millisec.

combined, it was concluded that (a) the RT mean of 278 millisec. for the first test day (listed as "Test Day 5" in Table 3) was significantly longer than the RT means for all subsequent days, (b) the RT mean of 254 millisec. for the second test day was significantly longer than the RT means for all subsequent days, and (c) the RT means of 230, 223, 223, and 221 millisec. for test days three through six were not significantly different.

With the objective of arriving at measures of well-practiced performance for paired responses, these results were interpreted as justifying elimination of measures for the first two test days. Interpretation of results for test days three through six was less securely anchored. Although the hypothesis of random variation among RT means during the last four days was found tenable, it should be noted that there was a generally progressive decrease in means. Evidently these differences were too small to be established by this experiment. Even considering this probable state of affairs, however, it does not seem unreasonable to assume that the RT means during the last four days represent measures in which the major effects of practice have been eliminated. On the basis of this assumption, it was decided that the pooled RT measures over the last four days would provide reasonable estimates of well-practiced performance for paired responses.

It is recognized, of course, that an analysis of practice effects for the left hand does not necessarily provide information on the right hand in paired responses. However, an examination of the right hand RT's for several

TABLE 4.—F-RATIOS FOR LEFT HAND REACTION TIME MEASURES IN PAIRED RESPONSES FOR SIX DAYS AND TWO STIMULUS CONDITIONS

Source	df	F	Confidence Level 5%/1%
Between Stimulus Conditions (S)	1/8	0.06	5.32/11.26
Between Days (D)	5/40	12.81	2.45/3.51
Interaction: DxS	5/40	1.41	2.45/3.51

TABLE 5.—MEAN REACTION TIMES FOR RIGHT HAND IN PAIRED RESPONSES AT SELECTED STIMULUS INTERVALS FOR FOUR TEST DAYS
(Reaction Times in Millisec.)

Interval Between Response Stimuli (In Millisec.)	Test Days			
	7	8	9	10
50	320	311	316	312
250	247	242	246	240
500	262	263	252	257

intervals between response stimuli during the last four days suggests that this hand had also approached its optimum performance. As shown in Table 5, improvement in the right hand responses—for intervals of 50, 250, and 500 millisec. between response stimuli—appears to have been no greater than that for the left hand. The failure of the right hand to show a consistent trend, as was the case for the left hand, was possibly due to the fact that RT estimates were based upon only 10 daily measures for each *S* at each interval between response stimuli.

Interval between Stimuli. The mean RT's for the left and right hand in paired responses for two stimulus conditions and 10 stimulus intervals are presented in Figure I. In summarizing performance of the left hand in this

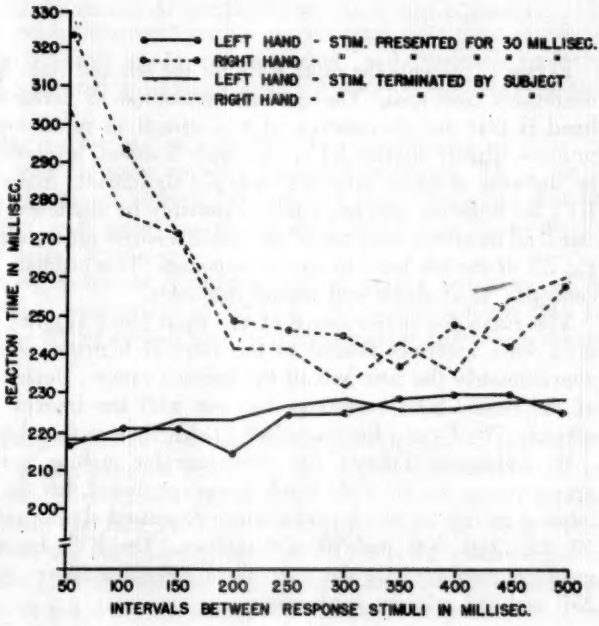

FIGURE I. Reaction times for paired responses as a function of the duration of stimuli and the interval between stimuli.

manner, it is clear that all intervals between response stimuli which are greater than the RT can have no sensible effect upon responses of the hand; however, this method of presentation does have the advantage of being parallel to that required for the right hand. It is also convenient for a comparison of RT's for stimulus conditions in which a second stimulus, for a second response, is presented either before or after completion of the response to a previous stimulus.

It would seem apparent from inspection of Figure I that, for either hand, there was no consistent difference in RT means for the two stimulus conditions. As shown in Table 6, the *F*-ratios for this effect were not significant.

TABLE 6.—F-RATIOS FOR LEFT AND RIGHT HAND REACTION TIME MEASURES FOR TWO STIMULUS CONDITIONS AND TEN STIMULI INTERVALS

Source	df	Left Hand	Right Hand	Confidence Levels 5%/1%
Between Stimulus Conditions (S)	1/8	0.04	2.23	5.32/11.26
Between Stimulus Intervals (I)	9/72	1.22	21.74	2.01/2.67
Interaction: SxI	9/72	1.91	0.72	2.01/2.67

Figure II presents the mean RT's for the left and right hand with stimulus conditions combined. The general impression of performance for the left hand is that the presentation of two stimuli in rapid succession tended to produce slightly shorter RT's. As Table 6 shows, however, the variance due to "between stimulus intervals" was not significant. Since the differences in RT's for stimulus intervals could reasonably be attributed to sampling variations, all measures were pooled to obtain a single estimate of 224 millisec. for the RT of the left hand in paired responses. This estimate was used for later comparisons of single and paired responses.

The curve for performance of the right hand (Figure II) indicates that RT's were inversely related to the interval between response stimuli over approximately the first half of the interval range. During the latter portion of the range, RT's tended to increase with the interval between response stimuli. The *F*-ratio for this effect (Table 6) was found to be significant.

By employing Tukey's (8) procedure for making multiple comparisons among means for the right hand, it was concluded that the RT's fell into five interval groups in which performance decreased significantly in the order of 50, 100, 150, 500, and 200-450 millisec. The RT's for these groups, with measures combined for the intervals of 200-450 millisec., were 314, 286, 271, 257, and 243 millisec. respectively.

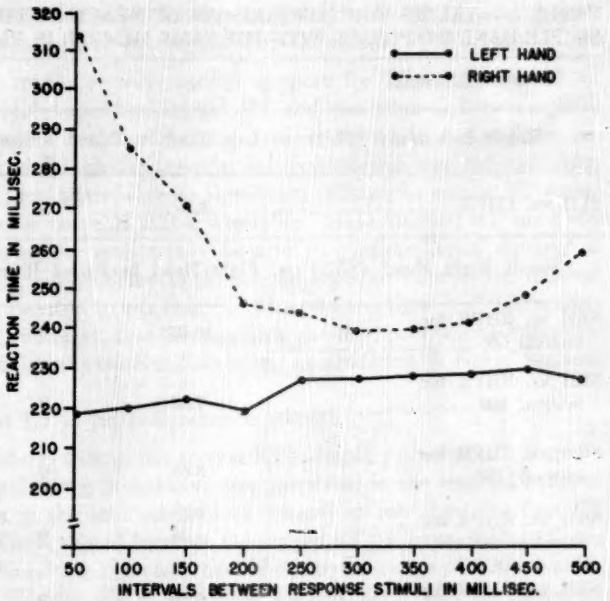

FIGURE II. Reaction times for paired responses as a function of the interval between stimuli.

Comparisons of RT Response. Comparisons among simple and paired RT's were based upon pooled measures for all experimental conditions which the previous analysis indicated to be nonsignificant, and Student's *t*-test for related measures was used to assess the significance of differences among means.

Table 7 summarizes the statistics yielded for comparisons of RT's for simple responses with the same member in paired responses. The *t* for all comparisons was significant beyond the required level, indicating that the simple response for each hand was significantly faster than those for the same member in paired responses.

The statistical evaluation of differences among paired responses of the left and right hand is summarized in Table 8. The results indicate that, for all comparisons, the RT of the left hand was significantly faster than that of the right hand.

Discussion

The general results of the present experiment provide further support for the hypothesis of a psychological refractory period. In agreement with the early reports on this phenomenon (1, 4, 5, 7, 9, 10), the interval between two successive stimuli was found to have a significant effect upon the second response. This effect was evidenced by increased RT's to the second stimulus, and these increases indicate that the events immediately following presentation of one stimulus can delay the response to a second stimulus.

TABLE 7.—*t*-VALUES FOR COMPARISONS OF REACTION TIME MEASURES IN SIMPLE HAND RESPONSES WITH THE SAME MEMBER IN PAIRED RESPONSES

Comparisons	t	df	Confidence Levels 5%/1%
Simple Left Hand (SLH) vs. Left Hand In Paired Responses (LHPR)			
SLH vs. LHPR	4.16	9	2.26 / 3.25
Simple Right Hand (SRH) vs. Right Hand In Paired Responses (RHPR)			
SRH vs. RHPR for interval 50[a]	10.72	9	2.26 / 3.25
SRH vs. RHPR for interval 100	9.82	9	2.26 / 3.25
SRH vs. RHPR for interval 150	8.65	9	2.26 / 3.25
SRH vs. RHPR for intervals 200-450	4.86	9	2.26 / 3.25
SRH vs. RHPR for interval 500	5.70	9	2.26 / 3.25

[a] Intervals in millisec.

TABLE 8.—*t*-VALUES FOR COMPARISONS OF REACTION TIME MEASURES IN PAIRED RESPONSES OF LEFT HAND (LHPR) AND RIGHT HAND (RHPR)

Comparisons	t	df	Confidence Levels 5%/1%
LHPR for intervals 50-500[a] vs. RHPR for interval 50	9.80	9	2.26 / 3.25
LHPR for intervals 50-500 vs. RHPR for interval 100	8.19	9	2.26 / 3.25
LHPR for intervals 50-500 vs. RHPR for interval 150	6.24	9	2.26 / 3.25
LHPR for intervals 50-500 vs. RHPR for intervals 200-450	3.67	9	2.26 / 3.25
LHPR for intervals 50-500 vs. RHPR for interval 500	4.56	9	2.26 / 3.25

[a] Intervals in millisec.

In comparison with the recent findings reported by Davis (2), the following details of agreement and divergence may be noted:

1. The present results provide further support for Davis' finding of an inverse relationship between the second RT and the interval between pairs of stimuli. For the *S*'s in the present experiment, there was a significant increase in the second RT as the interval between stimuli was reduced from 200 to 50 millisec., and there were no significant differences among RT measures over the interval range of 200-450 millisec. Since the first RT for these *S*'s was 224 millisec., the results may be said to confirm Davis' finding of "a progressively increasing delay in the second reaction time as the interval between stimuli is reduced to less than the first reaction time . . ." (2, p. 34).

It is to be noted, however, that the magnitude of the "progressively increasing delay" was consistently smaller than would be predicted by Davis' formula that

Delay = First RT — Interval between stimuli.

According to this formulation, the second RT's should progressively increase by an amount equal to the progressive step decreases in the interval between stimuli; decreases in the interval between stimuli to less than the first RT by steps of 50 millisec. should increase the second RT by steps of 50 millisec. With this step interval for decreases over the interval range of 200-50 millisec., the second RT's for *S*'s in the present experiment were increased by steps of only 28, 15, and 28 millisec. This, of course, indicates that the gradient for the "progressively increasing delay" was not as steep as would be predicted by Davis' formula.[1]

2. The present results would appear to be at variance with Davis' conclusion that the refractory period for simple key manipulation does not exceed the duration of the first RT. Although the finding of no difference among RT measures for the interval range of 200-450 millisec. suggests that delays in the second RT disappeared when the interval between stimuli reached 200 millisec., the condition of no difference between measures is not equivalent to "no delay" in the sense employed by Davis. As defined by Davis, states of delay or no delay, and the conditions under which they occur, may be summarized as follows:

When
  Interval between stimuli $<$ First RT
then
  Second RT $>$ First RT, i.e., a delay exists.

[1] Although the predicted step increases of 50 millisec. for the second RT's were based upon the assumption that the first RT's for intervals between stimuli of 200-50 millisec. were equal—and the analysis of these measures offered no basis for rejection of this assumption—the substitution of actual first RT values would not improve the situation to any great extent. Use of the actual first RT's would result in predicted step increases of 48, 48, and 52 millisec. for the second RT's.

And when

Interval between stimuli > First RT

then

Second RT ⋫ First RT, i.e., no delay exists.

Since the second RT's for *S*'s in the present experiment were greater than the first RT's throughout the entire range of 50-500 millisec. between paired stimuli, it would appear that delays extended well beyond the duration of the first RT, which was approximately 230 millisec.

The fact that the conditions of the present experiment varied in several respects from those followed by Davis makes it difficult to account for discrepancies in results. The most plausible suggestions, however, for differences in the duration of refractory period are to be found in (a) the possible intrusion of an expectancy effect and (b) the fact that the intervals between stimuli in the present experiment were limited to a range of 50-500 millisec., whereas Davis used a range of 50-1000 millisec.

That the results were possibly influenced by an expectancy effect is suggested in Figure II. Here it may be observed that the second RT's (right hand) tended to increase as the interval between stimuli approached the upper limits of 500 millisec. Although these increases were not always statistically significant, the general trend suggests that, during the course of six test days, *S*'s learned to recognize the range between stimuli and to react to this information. Presumably, on any given trial, as the interval between stimuli approached its upper limit, the greater was the expectation that the second stimulus would not appear, that is, that a catch trial was in the making. And the greater their expectation of a catch trial, the less ready were *S*'s to respond and the longer their RT's.

With the interval between stimuli compressed to a range of 500 millisec., it is plausible that termination of the refractory period was obscured by an overlapping of expectancy effects. In other words, the persistence of "delays" over the longer intervals between stimuli might have been due to expectancy rather than refractory effects. These suggestions, of course, are strictly *ex post facto* and will require experimental verification.

3. The present results are also at variance with Davis' finding that the first RT in paired responses was normal, that is, similar to the simple RT for the same member. For the *S*'s in the present experiment, the first RT in paired responses was found to be significantly longer than the normal RT. This latter result is rather surprising because the experimental conditions would appear to favor the first RT in paired responses: whereas the procedures for obtaining the normal RT involved catch trials and provided for a situation of responding or not responding, the catch trials in paired responses were confined to the second RT and provided for a situation of always responding with the first response member. Precisely what conditions produced the longer first RT's are not known, and any suggestions must be provided by further experimental analysis.

Summary

An experiment was performed for the purpose of obtaining further evidence on the details and conditions of the psychological refractory period with two groups of five *S*'s each. Both groups completed simple RT responses for each hand as well as paired RT responses involving the sequential movement of the left and right hands, and all responses were made to the presentation of light stimuli. The experimental procedures for groups varied only in regard to the duration of the stimuli: for one group, the stimuli were presented for a duration of 40 millisec.; for the other, the stimuli were terminated by movement of *S*'s hand off the appropriate signal key.

The essential results were: (a) the duration of response stimuli had no significant effect upon either simple or paired RT responses, (b) delays in the second RT in paired responses were found to persist throughout the entire range of 50-500 millisec. between stimuli, (d) for intervals between stimuli which were shorter than the first RT, the delays in the second RT were found to be inversely related to the interval between stimuli, and (d) the first RT in paired responses was found to significantly longer than the normal RT for that member.

The extent to which the present results supported or differ from previous reports on the psychological refractory period was noted.

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(Submitted 7/2/58)

Notes & Comments

NOTES

Effect of Vigorous Swimming on Blood Viscosity of Conditioned Subjects

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THE PURPOSE of this study was to determine to what extent vigorous exercise affected whole blood viscosity—more specifically, to determine to what extent swimming 300 yards within six minutes time affected the blood viscosity of trained swimmers.

Procedures

The subjects of this study were 34 healthy male students who were enrolled in two classes of a 16-week course in lifesaving and water safety at the Pennsylvania State University. The ages of these students were between 17 and 28. Each class met for 50 minutes, three times a week.

Beginning with the first class meeting, each student was required to train for a 300-yard swim. The subjects were to train until they could swim the distance within a six-minute period, using only the American crawl stroke. Nine weeks elapsed before every individual was able to swim the 300 yards within the designated time limit. They were then tested to determine to what extent swimming affected the absolute viscosity of blood.

All testing was done between the hours of 10 and 11 o'clock in the morning. On a specified day each subject reported for the test. On that particular morning he ate a very light breakfast which consisted of one cup of tea, two pieces of toast, one small bowl of cereal with no sugar, and one glass of fruit juice. The subjects did not participate in any type of vigorous exercise prior to the testing. This exclusion of exercise did not include walking to and from their regularly scheduled classes.

Upon reporting for the test, the subjects removed all their clothing. They did not take a shower but washed and dried their hands thoroughly. Each student then sat in an upright position on a bench for a period of 10 minutes. The bench was located in the warm pool area to help eliminate the possibility of a student becoming chilled. The average air temperature was 87° F.

After the 10 minute rest period had elapsed, each subject had blood extracted from the medius finger of the left hand by means of a spring lancet. The blood was immediately placed in a Hellige viscometer[1] to determine its relative viscosity .

As soon as each subject had his blood sample taken, he swam 300 yards within a six-minute period. The American crawl stroke was the only stroke used by the subjects for this purpose. After finishing the 300-yard swim, the subject dried his body thoroughly, especially his hands. Again blood was taken from the medius finger of the left hand and immediately placed in the viscometer.

Analysis of Data

The blood of 10 of the 34 swimmers became less viscous after swimming the 300 yards within six minutes. The blood of 23 of the swimmers became more viscous after the 300-yard swim, and one individual's whole blood viscosity remained unchanged.

[1] The procedures for using the viscometer were taken from the *Directions for Hellige Viscometer No. 1200.*

An insignificant critical ratio of .90 was obtained for the mean difference between blood viscosity readings immediately preceding exercise and blood viscosity readings directly following exercise. This critical ratio is not significant at the 5 percent level of confidence; hence, no real difference could be assumed in regard to blood becoming more viscous after one's participation in vigorous exercise.

TABLE 1.—CRITICAL RATIO BETWEEN WHOLE BLOOD VISCOSITY READINGS OF 34 SUBJECTS BEFORE AND AFTER SWIMMING 300 YARDS

	M	σ	σ m	σ diff.	Critical Ratio	r
Whole Blood Viscosity before 300-yard Swim	1.3324	.5063	.0868			
				.1015	.90*	.41
Whole Blood Viscosity after 300-yard Swim	1.4240	.5764	.0989			

*Not significant at the 5 percent level of confidence.

Conclusions

The results of this study seem to indicate that:

1. Participation of conditioned subjects in vigorous swimming is not an important factor in causing blood to become more viscous.
2. There is wide variability in the effect of swimming on blood viscosity. In other words, exercise seems to cause blood viscosity to increase for certain conditioned individuals and, also, seems to cause a decrease for others.

(Submitted 2/15/58)

COMMENTS

Comment on the article "Influence of Perceptual Stimulus Intensity on Speed of Movement and Force of Muscular Contraction" in the March 1958 RESEARCH QUARTERLY.

Dr. Ernest Michael has called the writer's attention to a discrepancy between data in Table 1 of this article and statements on page 96 concerning these data. An unnoticed typographical error resulted in printing the average speed of movement for the sound of medium intensity as 0.13361 sec. in the table. The correct value is 0.13661 sec.—*John M. Vallerga, Montgomery High School, Santa Rosa, California.*

Research Abstracts

Prepared by the Research Abstracts Committee of the National Council of the Research Section, D. B. VAN DALEN, Chairman

61. WALTERS, C. ETTA, and PARTRIDGE, MIRIAM J. "Electromyographic Study of the Differential Action of the Abdominal Muscles during Exercise." *American Journal of Physical Medicine* **36**: 259-68; Oct. 1957.

Two female subjects (adult and 10-year-old) with good abdominal musculature uncomplicated by adipose tissue performed exercises on which observations were secured on the behavior of the upper and lower rectus abdominis; the anterior, middle, and posterior fibers of the external oblique and the middle fibers of the internal oblique. Recordings were also made on the rectus femoris. It was found that when the action of the hip flexors is minimized, the exercise becomes more difficult for the abdominal muscles. During an isotonic contraction, the upper rectus abdominis participates more in activities involving the upper part of the body, and the lower rectus abdominis is more active in exercises which tilt the pelvis. When both muscles are used as stabilizers, the muscle that is farthest from the weight that is being lifted is the one that fires the most. The sit-up, and its modification and variation in the trunk curl and the "V" sit-up, is one of the most effective exercises for all abdominal muscles. Leg circling is one of the few exercises which is performed mainly by the external obliques. The internal obliques participate in any activity involving a tilt of the pelvis. Trunk rotation is performed largely by the internal obliques.—*D. B. Van Dalen.*

62. WYNDHAM, M. B., and WARD, J. S. "An Assessment of the Exercise Capacity of Cardiac Patients." *Circulation* **16**: 384; Sept. 1957.

Determinations were made on trained men, normal laboratory workers, cardiac patients, and young goldmine recruits on 1-foot stepping stools and on a bicycle ergometer. Oxygen consumption, heart rates, and maximum breathing capacities were determined. It was shown that the heart rate is a linear function of oxygen consumption with normal men up to a maximum value called maximum "aerobic" oxygen consumption. Further increase in work does not produce a rise in oxygen consumption. Since the ventilation volume per minute at the maximum level of oxygen consumption is less than the maximum voluntary capacity, it was felt that the limit to oxygen consumption is set by circulatory factors.

With cardiac cases, it was suggested that the upper limit of effort would be the level of oxygen consumption at which breathlessness produces discomfort since this is probably the level of effort where cardiac output fails to show the normal response to exercise. The ventilatory response to exercise seemed to distinguish two clear categories of rheumatic heart disease patients. By using the patients' maximum level of oxygen consumption, it is possible to set up an objective index of safe levels of work and assess the influence of therapy.—*Ernest Michael.*

63. ZORBAUGH, HARVEY, *editor*. "Television and College Teaching." *Journal of Educational Sociology* **31**: 329-76; May 1958.

This entire issue consists of six articles related to the above topic. The articles themselves and the bibliography on page 370 should prove extremely useful for individuals and colleges venturing into the field of television.—*Bruce L. Bennett.*

64. BADEER, HENRY, and KHACHADURIAN, A. "Role of Bradycardia and Cold per se in Increasing Mechanical Efficiency of Hypothermic Heart." *American Journal of Physiology* **192**: 331; Feb. 1958.

The oxygen consumption and work of the heart were determined in the modified heart-lung preparation of 11 dogs. The oxygen uptake of the heart was determined with constant arteriol pressure and cardiac output under conditions of normothermia; normothermia with bradycardia induced with a cold thermode and hypothermia by cooling the blood.

The results showed that at 36.8° C. (normal) with a rate of 153 beats per minute, the efficiency was 8.5 percent, and with a reduced rate of 110 by cooling the S-A node, the efficiency increased to 9.1 percent but was not statistically significant. Under constant stroke work reducing the temperature from 36.6° C. (S-A cooling) to 31.5° C. (by hypothermia) decreased oxygen uptake from 6.5 to 5.4cc/100 gm/min. and increased the mechanical efficiency from 9.1 percent to 10.8 percent, statistically significant. Since there was no significant reduction in the oxygen consumption of the heart when the heart rate was reduced by cooling the S-A node, the suggestion is made that bradycardia following hypothermia plays a relatively minor role in reducing cardiac metabolic rate when pressure-volume load of the heart is kept constant. The metabolic effect of cold per se appears to be the chief factor for increasing the efficiency of the hypothermic heart.—*Ernest D. Michael.*

65. BEZNAK, MARGARET. "Cardiac Output in Rats during the Development of Cardiac Hypertrophy." *Circulation Research* **7**: 207-12; March 1958.

The cardiac output, reserve force of the heart, total peripheral resistance, blood pressure, and wet and dry weights of the heart were determined for groups of 6-10 rats before and at different times after aortic constriction. Such constriction, involving application of a silver ring 0.8 mm. in diameter just below the diaphragm, produces a left ventricular hypertrophy to the extent of a 45 percent increase of its original dry weight in three weeks. Cardiac output was determined by the direct Fick method and the maximum to which cardiac output can be raised by infusion of 3.5 percent polyvinylpyrolidone (PVP) into the right heart was used as a measure of the "reserve force" of the heart. This procedure does not account for cardiac output fluctuations due to changes in peripheral resistance that follow aortic constriction. Total peripheral resistance for the normal rats was 210,000 dynes/sec./cm.-5 increasing to 310,000 units three weeks after aortic narrowing, blood pressure rising to the hypertensive level both above and below the stricture in the same period. Cardiac output in normal rats was $48 + 4$ ml./min.: $131 + 10$ ml./min. following PVP infusion. Three weeks after aortic narrowing cardiac output was $50 + 5$ ml./min.; $178 + 11$ ml./min. following PVP infusion.

"These experiments furnish clear experimental proof that the cardiac hypertrophy which develops after aortic constriction leads to a heart which is not only enlarged but which is also stronger than it was before hypertrophy set in. It has to be born in mind that this cardiac hypertrophy resembles most closely a 'training' hypertrophy, taking place in normal undamaged muscle."—*D. E. Stuart* and *Ernest D. Michael.*

66. BRUCE, R. A., and JOHN, G. G. "Effects of Upright Posture and Exercise on Pulmonary Hemodynamics in Patients with Central Cardiovascular Shunts." *Circulation* **16**: 776; Nov. 1957.

Fifteen patients between the ages of 7 and 49 years were studied. Ten had septal defects, three had potent ductus arteriosus, and two had no shunts. The patients with central shunts showed some increase in pulmonary blood flow changing from supine to sitting position. The two patients without shunts showed decrease in pulmonary blood flow.

During grade walking of 10 percent at 1.7 m.p.h. the pulmonary arterial flow increased with the central shunt subjects; the pressure increased considerably in 6 of the 10. The arterial oxygen saturation showed a decrease with exercise in the upright posture with the ventral septal defective cases, if pulmonary disease is excluded.

The results indicate that subjects with circulatory shunts differ in respect to posture and exercise from normal and cardiac patients without shunts. The changes indicate the magnitude of the pressure and work loads on the heart under these circumstances. —*Ernest D. Michael.*

67. Choh-Luh, Li, and Gouras, P. "Effect of Cooling on Neuromuscular Transmission in the Frog." *American Journal of Physiology* **192:** 464; March 1958.

Indirect and direct electrical stimulation of frog muscle caused contraction at –1° C., but it was sluggish and at times seen only with a microscope. During cooling, as the temperature reached 5° C. the intensity of the current needed for contraction increased. At –2° C. no response was attainable.

The resting membrane potentials did not significantly change to –1° C.; then at –2° C. they also disappeared. The frequency of endplate potentials varied with the fibers and with time. Between temperatures of 20° and 25° C. the frequency ranged from 10 to 1000/min. When a microelectrode was left in a fiber at a constant temperature the frequency increased. As the muscle was cooled the endplate potentials became larger until around 5°, when they were smaller than normal. There seems to be a critical temperature below which neuromuscular transmission becomes impeded although the junction is still capable of transmitting impulses.—*Ernest D. Michael.*

68. Dwyer, Robert J. "A Report on Patterns of Interaction in Desegregated Schools." *Journal of Educational Sociology* **31:** 253-56; March 1958.

Conclusions of this study were based on data obtained from observing seven school districts in Missouri where desegregation had been carried on for one or two years. Five general findings were noted:

1. Integration most readily occurs among the younger children, although the parents of these children express the most opposition to desegregation. At the secondary level there is little difference on the basis of age or grade.
2. Boys adjust to integration more readily than girls. This difference is due in large part to team sports.
3. The elementary school situation is more informal, and children express their feelings more spontaneously unless there is adult interference. Games, songs, and play contribute to this informality.
4. Although integration was the practice in school activities, there was no carry-over into after-school activities where community patterns and residential segregation dominated behavior.
5. The second year of integration showed more interaction and more spontaneous interaction than in the first year.—*Bruce L. Bennett.*

69. Eichorn, Dorothy, and McKee, John P. "Physiological Instability during Adolescence." *Child Development* **29:** 2; June 1958.

Physiological data from the files of the Adolescent Growth Study were used to test the hypothesis that adolescence was characterized by a temporary decrease in physiological stability. For systolic and diastolic blood pressure and for pulse rate intra-individual variability increases throughout the period from 12 to 18 while variability in BMR decreases. Variability in body temperature shows little systematic change. Aside from these over-all slopes, no evidence of a temporary period of heightened variability was found for girls and only a slight indication was found for boys.—*D. B. Van Dalen.*

70. ELAM, J. O., GREENE, D. G., BROWN, E. S., and CLEMENTS, J. A. "Oxygen and Carbon Dioxide Exchange and Energy Cost of Expired Air Resuscitation." *Journal of the American Medical Association* **167**: 328-34; May 1958.

This article represents a review of several studies. Because of the presence of a dead space, the rescuer, using the mouth-to-mouth method, can supply 10L/m. of air containing 18 percent O_2. The victims expired air will contain 15 percent O_2, and 3.9 percent CO_2. The arterial blood of the victim usually contained more than 90 percent O_2 and 26.6 percent CO_2.—*Peter V. Karpovich.*

71. FEINBLATT, H. M., and GANT, J. C. "Palliative Treatment of Benign Prostatic Hypertrophy, Value of Glycine-Alanine-Glutamic Acid Combination." *Journal of the Maine Medical Association* **49**: 99; March 1958.

In a blind controlled study of 40 cases of diagnosed benign prostatic hypertrophy (referred or checked by a urologist), the use of glycine-alanine-glutamic acid capsules for a period of three months reduced the prostatic enlargement in 92 percent, to normal size in 33 percent. Nocturia was relieved in 95 percent of cases (completely in 72 percent), urgent urination in 81 percent, frequency in 73 percent, discomfort in 71 percent, and delayed micturition in 70 percent. No comparable improvement was observed in the controls who were given a placebo. No untoward effects were observed in any case. The *modus operandi* appears to be an anti-edemic (diuretic) action whereby edematous swelling affecting the prostate gland and surrounding perineal tissues is reduced. A special metabolic activity may be a factor. Prostall capsules contain 6¼ grams of a mixture of glycine, alanine, and glutamic acid. The dosage used was two capsules three times daily for the first two weeks, thereafter one capsule three times daily.—*H. M. Feinblatt* and *J. C. Gant.*

72. FLEISHMAN, EDWIN. "A Relationship between Incentive Motivation and Ability Level in Psychomotor Performance." *Journal of Experimental Psychology* **56**: 1; July 1958.

Four hundred basic trainees at Lackland Air Force Base received training on the Complex Coordination Test in which a subject must make an appropriate adjustment of stick and rudder controls in response to successively presented patterns of visual signals. The subjects were divided into low-ability and high-ability groups. Half of the subjects in each of these groups received five minutes of "motivation" instruction between trials five and six; the other half rested during this period.

Inspection of the learning curves indicated that each group improved at about the same rate and in an approximately linear fashion. Although the supplementary "motivation" instructions made no difference in the over-all performance of the low-ability subjects, these instructions made a significant difference in the performance of the high-ability subject.—*Edna Willis.*

73. FRANK, N. R., *et al.* "The Mechanical Behavior of the Lungs in Healthy Elderly Persons." *Journal of Clinical Investigation* **36**: 1680; Dec. 1957.

Values of total lung capacity and its subdivisions were measured in 28 healthy subjects 50 years and older, and these values were compared to 11 adults 22-47 years of age. The older subjects showed a shift in static volume-pressure curve of the lungs to the left. The pulmonary flow-resistance was above 3.0 cm. H_2O per L. per sec. in 10 of the older subjects and in only one of the younger subjects.

In the older subjects the dynamic compliance decreased as the respiratory rate increased for those having flow resistance above 3.0 cm. H_2O per L. per sec. The results were similar but less than those found in emphysema. They were associated with an increased functional residual capacity, decreased vital capacity, and no change in total lung capacity.—*Ernest D. Michael.*

74. Gordon, A. S., Frye, C. W., Gittelson, L., Sadove, M. S., and Bettie, E. J. "Mouth-to-Mouth Versus Manual Artificial Respiration for Children and Adults." *Journal of the American Medical Association* **167**: 320-28; May 1958.

Part I of the study was concerned with infants and small children under general anesthesia. The mouth-to-mouth method was compared with the back-pressure arm-lift, back-pressure hip-lift, chest-pressure arm-lift (Silvester), and manual rocking. With an endotracheal tube, all three push-pull methods gave ventilation greater than normal during sleep. The rocking method gave less than normal. The mouth-to-mouth method was superior to them all.

Without the endotracheal tube but with "a basal metabolism apparatus type rubber mouthpiece inserted between the lips and teeth" and a noseclip, the rocking method failed to ventilate in most cases. The other manual methods also failed on many occasions, unless a finger was placed in the subject's mouth to keep the airways open. The mouth-to-mouth method was always adequate.

Part II treated anesthetized adults, for whom all methods were adequate if the endotracheal tube was used. With the mouthpiece and noseclip the manual methods became inadequate in 25 to 50 percent of cases, whereas the mouth-to-mouth method still remained adequate. The importance of keeping the neck extended to prevent obstruction of the air passages was emphasized.—*Peter V. Karpovich.*

75. Gregg, Lee. "Changes in the Distribution of Muscular Tension during Psychomotor Performance." *Journal of Experimental Psychology* **56**: 1; July 1958.

The relationship between changes in distribution of tension and changes in proficiency of performance was investigated in two experiments using an arm-hand steadiness task and a tapping-aiming task. In the first experiment, 25 subjects practiced the two tasks during four consecutive days. Muscle-action potentials of the muscle groups involved were recorded. On the third and fourth days the subjects wore packboards with loads of 67 pounds. In the second experiment ten subjects were assigned to each of six groups. Between trials each group except the control group performed work designed to fatigue the special muscle groups involved in the tasks. In the case of all muscle groups there was an increase in muscle-action above that of the resting level. The condition of fatigue altered proficiency in the performance of tasks in such a way that increase in tension appeared to accompany a decrease in proficiency.—*Edna Willis.*

76. Holand, Harold, and Pleyte, A. A. "Tuberculin Tests." *Today's Health* **35**: 38-41; Dec. 1957.

Many physicians are convinced that the tuberculin skin test is of utmost importance in the diagnosis of tuberculosis. The test is made by injecting in the forearm a measured amount of fluid called "tuberculin." If the patient has been infected, he is fairly sure to have a small reddened elevation at the point of the injection 48 to 72 hours later. Koch developed tuberculin in 1891. The tuberculin skin test's value is as follows: (1) a direct aid in finding unknown cases particularly among school children, (2) a watchdog against development of serious tuberculosis, (3) one of our most significant tests in the differential diagnosis of chest conditions that cast shadows on X-rays, (4) a clue to the case that infected the reactor, (5) as a means of community health education, and (6) a method of research.—*J. Grove Wolf.*

77. Hunt, Edward E., *et al.* "Somatotype and Sexual Maturation in Boys: A Method of Developmental Analysis." *Human Biology* **30**: 1; Feb. 1958.

The senior author devised a chronological method of describing sequences of stages of human maturation. The procedure can be used whenever ratings of somatic development are available for children of various ages. The technique is based upon concepts of statistics and logarithms and has both versatility and generality. One can compute the variability of a group of children in attaining the stages of maturation, a develop-

mental age equivalent for each stage, and, at any desired age, the incidence of children in the population who are within the different stages.

The procedure was applied to the stages of sexual maturation which had been recorded in 226 boys at a New England boarding school. For each of the five somatotype subgroups, the authors calculated the variability of attaining the stages. The data agreed with other findings that mesomorphy is associated with early maturation. In predominately mesomorphic boys, attainment of the stages was slightly more variable than the averages, and the velocity of maturation was about average. The ectomorphs showed a small variability in the ages of attainment of the stages, but the velocity was 44 percent faster than the average. The endomorphic boys showed high variability in the ages of attainment of the stages and early onset and late ending of sexual maturation; the velocity was low.—*D. B. Van Dalen.*

78. JOHNSON, WARREN R. "Emotional Upset and Psychosomatic Problems in Coaching." *Athletic Journal* **37**: 44-46; Feb. 1957.

The hazard of prolonged emotional stress has quite needlessly driven good men out of the coaching profession. The type of stress may aggravate numerous physical and mental disturbances and may lead to such symptoms as ulcers, indigestion, skin disorders, headaches, and circulatory disturbances. Every coach should have a regular physical examination and periodic medical check-ups, be moderate in his habits, and prepare himself for the sports season. A program should be adopted to include adequate rest and sleep, a well-balanced diet, and a sound exercise (conditioning) regime preliminary to the start of the season's schedule.—*J. Grove Wolf.*

79. JONES, MARY C. "The Late Careers of Boys Who Were Early or Late Maturing." *Child Development* **28**: 1; March 1957.

Boys who had been classified as physically accelerated or retarded in terms of skeletal age during adolescence were compared as young adults at age 33 to determine the long-term effects of rate of maturing upon personality. The physical differences noted for these boys tended to disappear in adulthood. Personality characteristics, as appraised by the California Psychological Inventory and the Edwards Personal Preference Schedule, showed a number of significant differences on the various scales for which the tests are scored (e.g., higher scores for the early maturing on measures of "good impression" and "socialization"). When such differences were found, they tended to describe the young adults much as they had been described in adolescence. No differences were found between the groups in present marital status, family size, or educational level. A few of the early-maturing made exceptionally rapid progress as junior executives, and a few of the late-maturing are still somewhat unsettled vocationally.—*D. B. Van Dalen.*

80. LEVY, MATTHEW N. "Relative Influence of Variations in Arterial and Venous Pressures on Resistance to Flow." *American Journal of Physiology* **192**: 164-74; Jan. 1958.

The denervated hind legs of dogs were used to study the pressure flow data during elevations of venous pressure as compared with those secured during reductions of arterial pressure. The results showed that the pressure flow data are slightly above the line of constant resistance with elevated venous pressure; the data fall markedly below the constant resistance line. With variations in arterial pressure, the resistance diminishes as the pressure gradient exceeds the reference value and resistance increases for values less than this level. The changes in resistance are only slight when venous pressure is changed. As the pressure gradient is reduced through an increase in venous pressure there is nly a very slight diminution in resistance.

The minute changes with venous pressure changes and the comparatively great deviations with arterial pressure changes are due to the physical properties either of the vessels or of the blood. It is suggested that the most probable explanation concerns the distensible elements in the vascular bed.—*Ernest D. Michael.*

81. MEREDITH, H. V. "A Time Series Analysis of Growth in Nose Height during Childhood." *Child Development* **29**: 1; March 1958.

The individual growth of the skeletal nose was determined by roentgenograms of North American white children of northwest European ancestry, at consecutive ages between 5 and 14 years. Between ages 5 and 12 there are three types of individual magnitude trend for nose height: an ascending curvilinear trend concave downward, an ascending rectilinear trend, and an ascending curvilinear trend concave downward during the first half of the period and convex downward in the last half. The increase in nose height of some children is twice that of other children in both absolute and relative increments. There is little relationship between the growth rate of nose height in early childhood and that in late childhood. For the period from 5 to 10 years, growth in nose height is not highly related to growth in any of the other variables of the head and face.—*D. B. Van Dalen.*

82. MEREDITH, HOWARD V. and E. MATILDA. "Concomitant Variation of Measures of Body Size on Boys 5 Years of Age and Measures of Growth Rate for the Ensuing Sexennium." *Growth* **22**: 1; March 1958.

This was a study of the correlation existing between 15 anatomical measures taken on North American white males at age 5 years and (1) the same measures taken at age 11 years and (2) the percentage change in the measures during the 5 to 11 year age growth period. Twelve of the traits were measured on 100 subjects, and three, which involved roentgenograms, were measured on 57 subjects. The anatomical variables were: head length, head width, upper face width, nose height, face depth, lower face width, stem length, shoulder width, arm girth, thorax girth, hip width, lower limb length, leg girth, stature, and body weight.

The only statistically significant correlations (r) between measurements at age 5 and those taken at age 11 years were as follows: lower limb length 0.56, body weight 0.55, stature 0.42, arm girth 0.41, thorax girth 0.36, leg girth 0.35, hip width 0.23, and stem length 0.25. When the correlations were based on measurements taken at age 5 and percentage growth gains, the coefficients for the above listed variables dropped to extremely low values and most of them became statistically insignificant. The facial measurements, however, began to show slightly significant negative correlations.

The authors also analyzed data taken from other studies. These data were selected measurements taken at birth and age 1 year and measurements taken at age 1 year and 5 years. The coefficients based on initial measurements and subsequent percentage growth increases were much higher than in the previous analysis of growth from 5 to 11 years. The coefficients were negative and ranged from about 0.40 to 0.70.—*Benjamin H. Massey.*

83. MILLMAN, MAX. "How Many Calories Do You Need?" *Today's Health* **34**: 18-21, 41; Nov. 1956.

A calorie is the amount of heat required to raise the temperature of one kilogram of water one degree centigrade. The calorie is a measure of heat, work, and food. The average normal person, at rest, uses approximately 25 calories for every kilogram of body weight during a 24-hour period. Another basic need for calories comes from physical activity. Excellent tables are included for the calorie allowances based on ideal weights for men and women.—*J. Grove Wolf.*

84. MILLMAN, MAX. "What It Takes to Reduce." *Today's Health* **35**: 30-31, 46, 48-50; April 1957.

Overweight is always curable; there are no exceptions to this rules. Knowledge, incentive, and drive are the three essentials that will help you and your doctor fight the dangers of overweight. Knowledge of the nature and hazards of obesity and the benefits that come with safe and scientific weight loss are of utmost importance. The best-

informed patients get the best results. The doctor is available to help you develop incentive, insight, and self-confidence in attacking what many authorities have stated is our Number 1 health problem, obesity.—*J. Grove Wolf.*

85. MUSSEN, P. H., and JONES, MARY C. "Self-Conceptions, Motivations, and Interpersonal Attitudes of Late and Early Maturing Boys." *Child Development* **28**: 2; June 1957.

Thirty-three 17-year old boys—16 physically accelerated throughout adolescence and 17 consistently retarded—were analyzed according to a scoring scheme. Analysis of the data indicates that the physically retarded boys are more likely to have negative self-conceptions, feelings of inadequacy, strong feelings of being rejected and dominated, prolonged dependency needs, and rebellious attitudes toward parents. In contrast, the early maturing boys present a more favorable psychological picture during adolescence. Relatively few of them felt inadequate, rejected, dominated, or rebellious toward their families. More of them appeared to be self-confident, independent, and capable of playing an adult role in interpersonal relationships. Early and late maturing groups did not differ significantly from each other in needs for achievement or personal recognition.—*D. B. Van Dalen.*

86. PHELPS, H. R., and HORROCKS, J. E. "Factors Influencing Informal Groups of Adolescents." *Child Development* **29**: 1; March 1958.

A questionnaire was developed and administered to students in grades 7 through 12 in a small Ohio community to secure evidence of their activities and standards of social acceptability. An adaptation of multiple factor analysis was used. Ten factors emerged from the analysis, nine of which were tentatively identified. They are: available automobile transportation; need to conform to certain moral standards; nonemancipated home, school, and community centered activities; low socio-economic status; pressures leading to the assumption of an upper socio-economic, quasi-adult social role; good appearances; masculine role; pressures from adult domination and lack of emancipation from the home; and need for approval and status growing out of pressures applied by the middle class family.—*D. B. Van Dalen.*

87. READ, R. C., *et al.* "Venous Pressure and Total Peripheral Resistance in the Dog." *American Journal of Physiology* **192**: 609; March 1958.

Studies were performed on dogs by elevating the venous pressure through increasing the resistance to outflow in a catheter. Arterial pressure increased at the same time venous pressure rose but arteriovenous pressure difference decreased so that the calculated resistance fell during the venous pressure rise. The study showed that an increased venous pressure failed to cause a vasoconstrictor response. It supports the British findings that a decline in vascular resistance is observed with increased venous pressure. The conclusion is made that a reflex vasoconstrictor response to venous distention is not characteristic of the circulation as a whole.—*Ernest D. Michael.*

88. REICHERT, JOHN L. "Competitive Sports before the Teens." *Today's Health* **35**: 28-31; Oct. 1957.

Highly competitive athletics has been defined as competition in which the chief stress is placed on winning; excessive emotional pressures are applied by teachers, parents, and others; and parental interest goes to the point of expressing undue concern over winning and losing. The author, a noted pediatrician, has refuted many of the arguments of those in favor of highly competitive athletics. He makes ten recommendations to serve as a basis for giving teenagers most of the advantages and a minimum of the disadvantages of athletic programs: (1) Competition is an inherent characteristic of growing and developing children, which if properly guided can be beneficial, (2) opportunity should be available to develop skills in a variety of activities, (3) athletics should

involve all of the children in a school, (4) opponents should be matched according to their physical and emotional level as well as to their age, size, body build, and level of maturity, (5) body contact sports, particularly football, boxing, and wrestling are dangerous at this age, (6) secure the best possible professional leadership, (7) all competitive athletic programs should be organized with the cooperation of the local medical group, (8) interschool and intercommunity contests are not recommended for children of this age; neither are state, regional, national, or similar tournaments recommended, (9) athletics should be so designed as to be of educational as well as recreational value, and (10) provision should be made to include those children who are physically or psychologically handicapped.—*J. Grove Wolf.*

89. Russell, R. D. "Speaking of School Accidents." *Journal of School Health* **28**: 6; June 1958.

An analysis was made of accidents reported to the school nurse during the academic year 1956-57 by students in grades 1-12 at Punahou School, Honolulu, Hawaii. The school is independent, nondenominational, and under the jurisdiction of the United States. Of its student body of 2,813, 20 percent were of Oriental, 10 percent of Hawaiian, and 70 percent of white-Caucasian ancestry. Injuries occurring during competitive high school athletics were excluded from the study.

The accident ratio was found to be 5.5/100 students; the months of highest incidence were March, February, and April. Accidents occurred most frequently during or near the lunch period (25%), twice as often to boys as to girls, and most often to students aged 11-13 (46.5%). Orientals sustained proportionately fewer injuries than other students. One-fourth of the 155 accidents happened on the playground and another fourth in physical education classes.

The three most frequent types of injuries were sprains or strains (37%), cuts (29%), and bruises (15%). The extremities were involved in 57 percent of the accidents. The fact that children below grade 6 attended school barefooted and most students in grade 7 and above wore no shoes for physical education classes probably accounts for the rather high percentage (17%) of injuries to the toes and feet. Track activities were cited as being the most dangerous for boys in grades 6-8 with 5 of the 8 track injuries in high jumping. Only 3 trampoline accidents were reported during 1956-57. No further breakdown by activity was given.—*Jane A. Mott.*

90. Safar, P. "Ventilatory Efficacy of Mouth-to-Mouth Artificial Respiration." *Journal of the American Medical Association* **167**: 335-41; May 1958.

The back-pressure arm-lift, chest-pressure arm-lift and mouth-to-mouth methods were used on 27 anesthetized adult subjects varying in weight from 101 to 210 pounds. No endotracheal tube was used. The author found that the pharynx of every anesthetized subject became obstructed when the neck was flexed, no matter whether a prone or a supine position was used. He also observed the "valve-effect" of the pharynx, which caused resistance to inspiration and expiration.

When the head is left in natural position, the back-pressure arm-lift method failed in 11 out of 15 cases (73%) and the chest-pressure arm-lift method failed in 75 percent. When the neck was straightened, the ventilation produced by the back-pressure arm-lift method was less than the dead space capacity only once out of seven cases. The author strongly recommends the use of a special rubber mouthpiece for keeping airways open and the neck in extension.

The mouth-to-mouth method is superior to all other methods if performed correctly. The neck is extended and the lips are open. If the rescuer interposes his thumb and index finger in the form of a ring between the victim's lips and his own lips, air leakage and obstruction by the victim's lips occur.—*Peter V. Karpovich.*

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Index for Volume 29 [1958]

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Authors and important topics are indexed. Topics selected for indexing are those for which the article supplies information or data. The brief descriptive phrase is followed by the author's name, month, and page of reference.

abdominal muscles
  relation of strength to low back pain, Flint, M. Marilyn, May: 160
Abstracts
  of research articles, Mar.: 120; May: 247; Oct.: 370; Dec.: 484
action potentials
  in unexercised arm, Sills, F. D., and Olson, A. L., May: 213
administration
  effect on school health service practices, Neilson, Elizabeth A., and Irwin, L. W., Dec.: 417
age
  effect on interest in marriage problems, Lantagne, J. E., Dec.: 407
anthropometric measures
  effect of weight training, Kusinitz, I., and Keeney, C. E., Oct.: 294
  relationship to oxygen intake, Royce, J., Mar.: 60
archery
  relation of lateral dominance to, Way, Eunice E., Oct.: 360
athletes
  personality traits of, Booth, Jr., E. G., May: 127
attitudes
  analysis of measurement scales in health education, Mayshark, C., Oct.: 309
  toward safety, scale to measure, Myers, F. H., Oct.: 320
back muscles
  relation of strength to low back pain, Flint, M. Marilyn, May: 160
badminton
  relation of lateral dominance to, Way, Eunice E., Oct.: 360
basic skills
  effect of instruction in, on motor learning, Broer, Marion R., Dec.: 379
basketball
  effect of basic skills instruction on, Broer, Marion R., Dec.: 379.
  effect of warm-up on, Thompson, H., May: 231
  reliability of tests for junior high school girls, Broer, Marion R., May: 139
behavior
  of physical education teachers, Blank, L. B., Mar.: 1
  social, index for evaluating, Cowell, C. C., Mar.: 7
Blank, L. B., Mar.: 1
blood pressure
  effect of exercise on, Rochelle, Rene H., Dec.: 459
  measurement of, by strain gauge and pressure amplifier method, Rochelle, Rene H., Dec.: 459
  effect of psychic stress on, Hennis, Gail M., and Ulrich, Celeste, May: 172
blood viscosity
  effect of vigorous swimming on, Thompson, H. L., Dec.: 482
body build
  relationship to toe-touch test, Broer, Marion R., and Galles, Naomi R. G., Oct.: 253
body type
  relation to flexibility, Tyrance, H. J., Oct.: 349
Booth, Jr., E. G., May: 127
bowling
  effect of warm-up on, Thompson, H., May: 231
  relation of lateral dominance to, Way, Eunice E., Oct.: 360
Brocket, J. E., May: 200
Broer, Marion R., May: 139; Oct.: 253; Dec.: 379
Buxton, Doris, Mar.: 116

cerebral palsy
effect on strength of two weight-training methods, Healy, A., Dec.: 389
cholesterol
review of research, Pohndorf, R. H., May: 180
circulation
normal and occluded, isometric fatigue curves in the, Royce, J., May: 204
cold
effect on fatigue level and work output of muscle, Grose, J. E., Mar.: 19
community size
effect on school health service practices, Neilson, Elizabeth A., and Irwin, L. W., Dec.: 417
coordination
hand-eye, effect of psychic stress on, Hennis, Gail M., and Ulrich, Celeste, May: 172
Coppock, Doris E., May: 146
Cowell, C. C., Mar.: 7; Mar.: 46
Crisp, C. E., May: 200
critical incidents
in behavior of physical education teachers, Blank, L. B., Mar.: 1
Crowley, L. V., May: 200
dance
measurement of rhythmic ability, Simpson, Shirley E., Oct.: 342
Dearborn, T. H., May.: 154
democracy
in teaching, use of group dynamics, Welborn, G. S., Mar.: 102
depth perception
effect of psychic stress on, Hennis, Gail M., and Ulrich, Celeste, May: 172
Dixon, R. W., Mar.: 32
Dobias, R., May: 222
dominance
relation to motor ability and skill, Way, Eurnice E., Oct.: 360
electrocardiogram
effect of stress on, Rasch, P. J., Geddes, D. D., Stout, C. F., and O'Connell, E. R., May: 193
electrocardiography
study of Olympic wrestlers, Rasch, P. J., Cowell, H. S., Geddes, D. D., and O'Connell, E. R., Mar.: 46
Ellfeldt, Lois, Oct.: 264
endurance
effect of warm-up on, Thompson, H., May: 231
effect of weight training on, Kusinitz, I., and Keeney, C. E., Oct.: 294
Espenschade, Anna, Oct.: 274
exercise
action potentials in unexercised arm, Sills, F. D., and Olson, A. L., May: 213
effect of vigorous swimming on blood viscosity, Thompson, H. L., Dec.: 482
effect on venous blood pressure, Rochelle, Rene H., Dec.: 459
frequency and intensity in developing strength, Rarick, G. L., and Larsen, G. L., Oct.: 333
progressive resistance in developing back and abdominal strength, Flint, M. Marilyn, May: 160
Faires, L. B., Mar.: 54
fat
relation to motor fitness test scores, Riendeau, R. P., et al., May: 200
relation to oxygen intake, Royce, J., Mar.: 60
fatigue
isometric curves with normal and occluded circulation, Royce, J., May: 204
of muscle, effect on of heat, cold, and massage, Grose, J. E., Mar.: 19
Feldt, L. S., Oct.: 279
flexibility
effect of weight training on, Kusinitz, I., and Keeney, C. E., Oct.: 294
relation to body build, Broer, Marion R., and Galles, R. G., Oct.: 253
relation to body type, Tyrance, H. J., Oct.: 349
Flint, M. Marilyn, May: 160
football
factors affecting place kicking, Marshall, S., Oct.: 302
starting signals and movement times of players, Thompson, C. W., Nagle, F. J., and Dobias, R., May: 222
force
of muscular contraction, effect of intensity of stimulus on, Vallerga, J. M., Mar.: 93
Galles, Naomi R. G., Oct.: 253
Geddes, D. D., Mar.: 46; May: 193

golf
effect on learning of loopfilms, Nelson, D. O., Mar.: 37
Griffin, P. E., May: 200
Grose, J. E., Mar.: 19
group dynamics
use in teacher education, Welborn, G. S., Mar.: 102
gymnastics
comparison of two methods in teaching, Wickstrom, R. L., Mar.: 109
health
knowledge of college students, Dearborn, T. H., May: 154
study of school service practices, Neilson, Elizabeth A., and Irwin, L. W., Dec.: 417
health education
analysis of attitude measurement, Mayshark, C., Oct.: 309
Healy, A., Dec.: 389
heart
effect of stress on electrocardiograms of wrestlers, Rasch, P. J., Geddes, D. D., Stout, C. F., and O'Connell, E. R., May: 193
effect on of competitive wrestling, Rasch, P. J., Cowell, H. S., Geddes, D. D., and O'Connell, E. R., Mar.: 46
heat
effect on fatigue level and work output of muscle, Grose, J. E., Mar.: 19
Hennis, Gail M., May: 172
Hunt, M. B., Mar.: 54
interests
of high school students in marriage and parenthood, Lantagne, J. E., Dec.: 407
Irwin, L. W., Dec.: 417
Keeney, C. E., Oct.: 294
kicking
factors, affecting, in football, Marshall, S., Oct.: 302
kidneys
effects of amateur wrestling on, Rasch, P. J., Faires, L. B., and Hunt, M. B., Mar.: 54
kinesthesis
a theory of movement, Ellfeldt, Lois, and Metheny, Eleanor, Oct.: 264
Knapp, C. G., Mar.: 32
knowledge
health, of college students, Dearborn, T. H., May: 154
Kraus-Weber test
race and sex differences in performance, Espenschade, Anna ,Oct.: 274
relation to physical performance scores of children, Espenschade, Anna, Oct.: 274
scoring system for Buxton revision, Buxton, Doris, Mar.: 116
Kroll, W., Dec.: 396
Kusinitz, I., Oct.: 294
Lantagne, J. E., Dec.: 407
Larsen, G. L., Oct.: 333
Lazier, M., Mar.: 32
learning, motor
effect of basic skills instruction on, Broer, Marion R., Dec.: 379
effect of distribution of practice on, Knapp, C. G., Dixon, W. R., and Lazier, M., Mar.: 32
effect of loopfilms on, Nelson, D. O., Mar.: 37
loopfilms
effect on learning golf, Nelson, D. O., Mar.: 37
marriage
interests of high school students in, Lantagne, J. E., Dec.: 407
Marshall, S., Oct.: 302
massage
effect on fatigue level and work output of muscle, Grose, J. E., Mar.: 19
Mayshark, C., Oct.: 309
McKee, Mary Ellen, Oct.: 279
metabolism
body components as reference standards for basal rate, Royce, J., Mar.: 60
Metheny, Eleanor, Oct.: 264
method
comparison of, in teaching gymnastics and stunts, Wickstrom, R. L., Mar.: 109
motor ability
relation to lateral dominance, Way, Eunice E., Oct.: 360
reliability of Scott and Humiston tests, Broer, Marion R., May: 139
motor fitness
relation of body fat to performance, Riendeau, R. P., et al., May: 200

movement
and meaning, a theory, Ellfeldt, Lois, and Metheny, Eleanor, Oct.: 264
Myers, F. H., Oct.: 320
Nagle, F. J., May: 222
Neilson, Elizabeth A., Dec.: 417
Nelson, D. O., Mar.: 37
O'Connell, E. R., Mar.: 46; May: 193
Olson, A. L., May: 213
pain
low back, effect on of increasing back and abdominal strength, Flint, M. Marilyn, May: 160
parenthood
interests of high students in, Lantagne, J. E., Dec.: 407
personality
patterns of successful women physical educators, Thorpe, Jo Anne, Mar.: 83
traits of athletes, Booth, Jr., E. G., May: 127
physical education
behavior of teachers, Blank, L. B., Mar.: 1
physical fitness
effect of weight training on, Kusinitz, I., and Keeney, C. E., Oct.: 294
of fourth grade children, Espenschade, Anna, Oct.: 274
Pohndorf, R. H., May: 180
posture
relation of pectoral tightness to round shoulders, Coppock, Doris E., May: 146
practice
distribution of, effect on learning, Knapp, C. G., Dixon, W. R., and Lazier, M., Mar.: 32
effect on paired reaction time responses, Slater-Hammel, A. T., Dec.: 468
race
differences, in performance on Kraus-Weber test, Espenschade, Anna, Oct.: 274
Rarick, G. L., Oct.: 333
Rasch, P. J., Mar.: 46; Mar.: 54; May: 193
reaction time
of football players to various starting signals, Thompson, C. W., Nagle, F. J., and Dobias, R., May: 222
relation to wrestling ability, Kroll, W., Dec.: 396
to pairs of discrete stimuli, Slater-Hammel, A. T., Dec.: 468
recovery
following exercise, venous blood pressure during, Rochelle, Rene H., Dec.: 459
refractory period
in simple paired responses, Slater-Hammel, A. T., Dec.: 468
reliability
of skill tests, a comparison of methods for estimating, Feldt, L. S., and McKee, Mary Ellen, Oct.: 279
religion
effect on interest in marriage problems, Lantagne, J. E., Dec.: 407
repetition
effect on speed of arm extension, Swegan, D. B., Yankosky, G. T., and Williams, III, J. A., Mar.: 74
review
of cholesterol research, Pohndorf, R. H., May: 180
rhythm
instrument to measure, Simpson, Shirley E., Oct.: 342
Riendeau, R. P., May: 200
Rochelle, Rene H., Dec.: 459
Royce, J., Mar.: 60; May: 204
safety
attitude scale for seventh grade, Myers, F. H., Oct.: 320
sex
performance differences on Kraus-Weber test, Espenschade, Anna, Oct.: 274
Sills, F. D., May: 213
Simpson, Shirley E., Oct.: 342
Slater-Hammel, A. T., Mar.: 117; Dec.: 468
social adjustment
an index for evaluating, Cowell, C. C., Mar.: 7
softball
effect of basic skills instruction on, Broer, Marion R., Dec.: 379
reliability of tests for junior high schools, Broer, Marion R., May: 139
somatotype
relation to flexibility, Tyrance, H. J., Oct.: 349

specific gravity
relationship to oxygen intake, Royce, J., Mar.: 60
speed
effect of intensity of stimulus on, Vallerga, J. M., Mar.: 93
effect of repetition on, Swegan, D. B., Yankosky, G. T., and Williams, III, J. A., Mar.: 74
effect of warm-up on, Thompson, H., May: 231
relation of body fat to, Riendeau, R. P., May: 200
statistics
the one-tailed test, Slater-Hammel, A. T., Mar.: 117
steadiness
effect of psychic stress on, Hennis, Gail M., and Ulrich, Celeste, May: 172
stimulus
intensity of, effect on speed of movement, Vallerga, J. M., Mar.: 93
intensity of, effect on force of muscular contraction, Vallerga, J. M., Mar.: 93
variation of, effect on simple and paired reaction time responses, Slater-Hammel, A. T., Dec.: 468
Stout, C. F., May: 193
strength
effect of warm-up on, Thompson, H., May: 231
effect of weight training on, Kusinitz, I., and Keeney, C. E., Oct.: 294
frequency and intensity of isometric contractions in developing, Rarick, G. L., and Larsen, G. L., Oct.: 333
of back and abdominal muscles, effect on low back pain, Flint, M. Marilyn, May: 160
of cerebral palsy subjects following two weight-training programs, Healy, A., Dec.: 389
of muscle, effect on of heat, cold, and massage, Grose, J. E., Mar.: 19
of wrestlers, Kroll, W., Dec.: 396
stress
effect on electrocardiograms of wrestlers, Rasch, P. J., Geddes, D. D., Stout, C. F., and O'Connell, E. R., May: 193
psychic, effect on various physical measures, Hennis, Gail M., and Ulrich, Celeste, May: 172
Swegan, D. B., Mar.: 74; Oct.: 373
swimming
effect of warm-up on, Thompson, H., May: 231
effect on blood viscosity, Thompson, H. L., Dec.: 482
teacher education
use of group dynamics in, Welborn, G. S., Mar.: 102
teachers
critical incidents in behavior of, Blank, L. B., Mar.: 1
personality patterns of women physical educators, Thorpe, Jo Anne, Mar.: 83
tennis
relation of lateral dominance to, Way, Eunice E., Oct.: 360
test
of rhythmic ability, Simpson, Shirley E., Oct.: 342
one-tailed discussion of statistical model, Slater-Hammel, A. T., Mar.: 117
reliability of motor ability and sports skills, Broer, Marion R., May: 139
safety attitude scale, for seventh grade, Myers, F. H., Oct.: 320
scoring system for revised Kraus-Weber, Buxton, Doris, Mar.: 116
theory
of movement, Ellfeldt, Lois, and Metheny, Eleanor, Oct.: 264
Thompson, C. W., May: 222
Thompson, H. L., May: 231; Dec.: 482
Thorpe, Jo Anne, Mar.: 83
time patterns
effect on motor learning, Knapp, C. G., Dixon, W. R., and Lazier, M., Mar.: 32
tumbling
comparison of two methods in teaching, Wickstrom, R. L., Mar.: 109
typing
effect of warm-up on, Thompson, H., May: 231
Tyrance, H. J., Oct.: 349
Ulrich, Celeste, May: 172

Vallerga, J. M., Mar.: 93; Dec.: 483
visual aids
effect of loopfilm on golf learning, Nelson, D. O., Mar.: 37
volleyball
effect of basic skills instruction on, Broer, Marion R., Dec.: 379
reliability of tests for junior high school girls, Broer, Marion R., May: 139
warm-up
effect on physical performance, Thompson, H., May: 231
Way, Eunice E., Oct.: 360
weight
of wrestlers, Kroll, W., Dec.: 396
relation to motor performance, Riendeau, R. P., May: 200
relation to oxygen intake, Royce, J., Mar.: 60
weight-training
comparison of two methods with cerebral palsy subjects, Healy, A., Dec.: 389
effect on health and fitness of boys, Kusinitz, I., and Keeney, C. E., Oct.: 294
Welborn, G. S., Mar.: 102
Welch, B. E., May: 200
Wickstrom, R. L., Mar.: 109
Williams, III, J. A., Mar.: 74
work
of muscle, effect on of heat, cold, and massage, Grose, J. E., Mar.: 19
wrestling
effect of tournament stress on electrocardiograms of Olympic contestants, Rasch, P. J., Geddes, D. D., Stout, C. F., and O'Connell, E. R., May: 193
effects on kidneys, Rasch, P. J., Faires, L. B., and Hunt, M. B., Mar.: 54
electrocardiographic study of Olympic participants, Rasch, P. J., Cowell, H. S., Geddes, D. D., and O'Connell, E. R., Mar.: 46
success, factors related to, Kroll, W., Dec.: 396
X-ray
in determining flexibility differences, Tyrance, H. J., Oct.: 349
Yankosky, G. T., Mar.: 74

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